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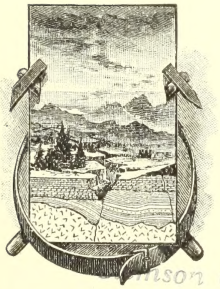
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

MINERAL RESOURCES
OF THE
UNITED STATES

CALENDAR YEAR
1909

PART I—METALS



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MINERAL RESOURCES OF THE UNITED STATES FOR 1909—PART I.

INTRODUCTION.

COOPERATION WITH THE BUREAU OF THE CENSUS.

Apologies are due to those interested in the annual volume, Mineral Resources of the United States, and to the public for the tardy publication of the report covering 1909. The delay is due to the fact that the statistics of mineral production in 1909 were collected under a cooperative agreement with the Bureau of the Census, the information desired by the United States Geological Survey being collected on schedules supplemental to the general schedules of the Census Office, and by the special agents of that bureau. By this arrangement the Bureau of the Census had the benefit of the lists of producers in the possession of the Geological Survey, and the latter, through the house-to-house canvass of the census agents, was able to secure revision of these lists. The Geological Survey has also no doubt benefited by a more complete canvass than is practicable in the conduct of an investigation where returns are received for the most part by mail.

On account, however, of the more detailed information required by the census schedules, the completion of the canvass was delayed beyond all expectation, and the benefit derived by the more thorough canvass has been seriously modified, if not rendered nugatory, by the tardy presentation of the results contained in the present volume. As it is, a number of the chapters from the report for 1910 have been completed, and others are in press at the time of the issue of the report for 1909.

It should be stated in justice to the Director of the Census, to Mr. William M. Steuart, the chief statistician for manufactures, to Dr. I. A. Hourwich, the expert special agent on mining, and to the other officials of the Bureau of the Census, that every effort has been made by them to carry out the spirit of the cooperative agreement and to facilitate the prosecution of the work.

CHARACTER AND SCOPE OF REPORT.

The arrangement and scope of this report are practically the same as in the 25 preceding reports of the series Mineral Resources of the United States. Each report records the development of the mineral industries of the United States since the time covered by the preceding number of the series; the reports should therefore be consulted together. Each chapter is a census of the productive features of the industry under discussion. The statistics of the imports and exports of minerals, which form an essential part of the volume, are obtained through the courtesy of the Chief of the Bureau of Statistics, Department of Commerce and Labor.

The summary gives the principal statistical information recorded in this report.

In presenting these statistics all unnecessary duplication has been avoided. The coke product, for example, discussed in the following pages and amounting in 1909 to 39,315,065 short tons, valued at $89,965,483, is excluded from the tabular statement, as the quantity and value of the coal used in its manufacture are included in the statistics of coal production. Similarly, white lead, red lead, litharge, and orange mineral, whose average aggregate value for the last 10 years has exceeded $15,000,000, are not given in the table, the base from which they are made being included in the output of pig lead. Zinc oxide, zinc lead, sublimed blue lead, and sublimed white lead, made directly from the ores, and consequently not included in spelter or lead production, are tabulated. The production of pig iron and its value are given in the table as the best means of presenting the statistics of the production of iron in the first marketable condition. The statistics of the production of iron ores are treated in a separate chapter, but are not included in the general statement of mineral products. The quantity and value of the production of iron ores are also shown in a footnote to the table of mineral products. In like manner the value of clay products is given as representing the first marketable condition of the clay resources of the country. Inflation of valuation and all unnecessary duplication are thus avoided as far as practicable.

In accordance with a change in the law (sundry civil appropriation act, approved May 27, 1908) governing the publication of this report, it will henceforth appear in two volumes, the first containing the statistics of the metals, and the second the statistics of the nonmetallic products of the country.

The discussion of the production of metals in the United States from domestic and foreign ores appears for the first time in this series of reports in the chapter on that subject by Waldemar Lindgren, published in this volume.

The discussion of the movement of Lake Superior iron ore also appears for the first time in this series in the chapter by John Birkinbine on that subject.

As heretofore, the publication of this report has been anticipated by the issue in advance, in pamphlet form, of the several chapters which compose it.

SUMMARY OF THE MINERAL PRODUCTION OF THE UNITED STATES IN 1909.

COMPILED BY W. T. THOM.

GENERAL REMARKS.[a]

The varied character of the units of measurement employed in the mineral industry makes it impossible to compare the outputs of the several minerals, except in the value of the products.

In 1905, for the first time, and in 1906, for the second time, the total value of the domestic mineral production exceeded the enormous sum of $1,500,000,000; and in 1907, for the first time, the still greater sum of $2,000,000,000 was exceeded.

In 1908 the disastrous results of the financial depression of the latter part of 1907 became only too apparent in the decrease in value of the mineral output, which declined for the year to about $1,595,000,000 from over $2,000,000,000 in 1907. In 1909 the general recovery in business carried the value of the domestic mineral production up to $1,886,144,323 from $1,594,643,260 in 1908, as compared with $2,071,607,964 in 1907, with $1,904,007,134 in 1906, and with $1,625,135,835 in 1905; a gain in 1909 from 1908 of $291,501,063, or 18.28 per cent; a loss from 1907 of $185,463,641, or 8.95 per cent; from 1906 of $27,862,711, or 1.46 per cent, and an increase over 1905 of $261,008,488, or 16.06 per cent.

As heretofore, iron and coal are the most important of our mineral products. The value of iron in 1909 was $419,175,000; the value of coal was $554,902,624. The fuels—coal, natural gas, and petroleum—increased from $716,660,749 in 1908 to $746,358,348, a gain of $29,697,599, or 4.14 per cent. Anthracite coal showed a decrease in value of $8,763,002 from $158,178,849 in 1908 to $149,415,847 in 1909. The increase in value of the bituminous coal output from 1908 was $31,351,509, from $374,135,268 in 1908 to $405,486,777 in 1909, an increase in the value of coal of $22,588,507, or 4.2 per cent.

The gain of $291,501,063 in the total value of our mineral production was due to gains in both metals and nonmetals, the metals, showing an increase from $549,923,116 in 1908, to $753,427,290 in 1909, a gain of $203,504,174, and the nonmetals showing an increase from $1,044,470,144 in 1908 to $1,132,417,033 in 1909, a gain of $87,946,889. To these products should be added estimated unspecified products including bismuth, cadmium, nickel, cobalt, and other mineral products valued at $300,000, which bring the total value of the mineral production for 1909 up to $1,886,144,323.

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[a] The imports cited in this summary and in the volume are "imports for consumption," which may or may not be identical with the "total imports" for the calendar year. Merchandise brought into the country late in December, for example, may be entered for consumption or it may be put into a warehouse and not be withdrawn for consumption until some months later. It will then be credited for consumption to the year of its withdrawal from the warehouse.

Add 1,289,826 barrels, valued at $812,590, to production of Portland cement in Indiana in 1909. Correction received too late for insertion.

METALS AND ORES.

Metals and metallic ores.—According to the report, published for the first time in this series in the volume for 1909, the output of metals in the United States in 1908 from domestic ores was valued at $530,408,214 and from foreign ores at $110,084,397, the total value being $649,779,613; the output in 1909 from domestic ores was valued at $720,033,414 and from foreign ores at $134,975,570, the total value being $870,445,230. The output of crude metallic ores of all kinds from domestic mines amounted in 1908 to 85,627,624 short tons, and in 1909 to 112,056,302 short tons.

Iron and steel.—Twenty-three States produced pig iron in 1909, as against 23 in 1908, 21 in 1907, 20 in 1906, and 20 in 1905. The total production of pig iron in 1909 was 25,795,471 long tons, as against 15,936,018 long tons in 1908, 25,781,361 long tons in 1907, 25,307,191 long tons in 1906, and 22,992,380 long tons in 1905. The production in 1909 showed an increase in quantity of 9,859,453 long tons, or 61.86 per cent, over the production of 1908, and an increase in value from $254,321,000 in 1908 to $419,175,000, amounting to $164,854,000, or 64.82 per cent. The average price per long ton of pig iron decreased from $20.56 in 1907 to $15.96 in 1908, and rose to $16.25 in 1909. The average prices of pig iron per long ton in 1906 and 1905 were: 1906, $19.98; 1905, $16.63. The imports of pig iron in 1908 (including pig iron, valued at $501,885; scrap, valued at $42,715; ferrochrome, $6,423; ferromanganese, $1,860,664; ferrosilicon, $281,590; ferrotungsten, $488; spiegeleisen, $125,054) were valued at $2,818,819; in 1909 the imports (including pig iron valued at $883,778; scrap, $773,529; ferrochrome, $43,504; ferromanganese, $3,396,381; ferrosilicon, $430,169; ferrotungsten, $93,205; spiegeleisen, $353,447; ferrophosphorus, $5,380) were 238,710 long tons, valued at $5,979,395. The exports (including scrap) were valued at $1,908,569 in 1907, at $1,118,926 in 1908, and at $1,399,151 in 1909.

Iron ore.—The production of iron ore in 1909 amounted to 51,297,271 long tons, as compared with 35,983,336 long tons in 1908, with 51,720,619 long tons in 1907, with 47,749,728 long tons in 1906, and with 42,526,133 long tons in 1905. The value at the mines of the ore mined in 1909 was $110,290,596, as compared with $81,845,904 in 1908, with $131,996,147 in 1907, with $100,597,106 in 1906, and with $75,165,604 in 1905. As in the ten preceding years the production of iron ore in the United States in 1909 was never equaled by that of any other country. The imports of iron ore in 1909 were valued at $4,579,078, against $2,220,133 in 1908 and $3,937,483 in 1907. The exports in 1909 were valued at $1,365,325, as against $1,012,924 in 1908 and $763,422 in 1907.

Manganese ore.—The production of manganese ore was 4,118 long tons, valued at $36,214 in 1905; 6,921 long tons, valued at $88,132, in 1906; 5,604 long tons, valued at $63,369, in 1907; 6,144 tons, valued at $62,779, in 1908; and 1,544 tons, valued at $19,675, in 1909. The average price per ton was $8.80 in 1905, $12.73 in 1906, $11.31 in 1907, $10.22 in 1908, and $12.74 in 1909. Manganiferous ores, carrying from 20 to 40 per cent of manganese, were produced to the extent of 68,654 long tons, valued at $215,925, in 1909, as against 55,620 long tons, valued at $132,556, in 1908; 103,844 long tons, valued at $259,473, in 1907; and 41,300 long tons, valued at $122,400, in 1906. The imports of manganese ore in 1909 were 212,765 long tons, valued at $1,405,329, as against 178,203 long tons, valued at $1,350,223, in 1908, and 209,421 long tons, valued at $1,793,143, in 1907.

Gold.—The production of gold increased from 4,265,742 fine ounces, valued at $88,180,700, in 1905 to 4,565,320 ounces, valued at $94,373,800, in 1906. It decreased in 1907 to 4,374,827 ounces, valued at $90,435,700, a loss in 1907 of 190,506 ounces in quantity and of $3,938,100 in value. In 1908 the output increased to 4,574,340 ounces, valued at $94,560,000, and in 1909 to 4,821,701 ounces, valued at $99,673,400, a gain in 1909 of 247,361 ounces in quantity and of $5,113,400 in value.

Silver.—The production of silver increased in quantity from 56,101,600 ounces in 1905 to 56,517,900 ounces in 1906; it decreased to 56,514,700 ounces in 1907, and to 52,440,800 ounces in 1908. The quantity increased to 54,721,500 ounces in 1909, a gain of 2,280,700 ounces. It increased in commercial value from $34,231,976 in 1905 to $38,256,400 in 1906, and decreased to $37,299,700 in 1907 and to $28,050,600 in 1908; in 1909 the commercial value was $28,455,200, a gain over 1908 of $404,600.

Copper.—The production of copper increased from 901,907,843 pounds, valued at $139,795,716, in 1905 to 917,805,682 pounds, valued at $177,595,888, in 1906; decreased in 1907 to 868,996,491 pounds, valued at $173,799,300; increased in 1908 in quantity to 942,570,731 pounds and decreased in value to $124,419,335; increased in 1909 in quantity to 1,092,951,624 pounds, a gain of 150,380,903 pounds, and increased in value to $142,083,711, a gain of $17,664,376. The imports in 1909 were valued at $38,762,951, against $29,664,129 in 1908 and $46,912,347 in 1907. The exports in 1909 were valued at $93,919,956, against $91,809,675 in 1908 and $103,252,917 in 1907.

Lead.—The production of lead in 1909 was 354,188 short tons, as against 310,762 short tons in 1908, 365,166 short tons in 1907, 350,153 short tons in 1906, and 302,000 short tons in 1905. The value of the production in 1909 was $30,460,168, as compared with $26,104,008 in 1908, with $38,707,596 in 1907, with $39,917,442 in 1906, and with $28,690,000 in 1905. The imports of lead were valued at $861,506 in 1909, as against $516,244 in 1908 and $1,082,944 in 1907. The exports were valued at $509,542 in 1909, against $599,640 in 1908 and $686,096 in 1907. The imports of type metal were valued at $532,108 in 1909 and at $156,847 in 1908.

Zinc.—The production of zinc in 1909 was 230,225 short tons, as against 190,749 short tons in 1908, 223,745 short tons in 1907, 199,694 short tons in 1906, and 203,849 short tons in 1905. The value of the zinc production in 1909 was $24,864,300, as compared with $17,930,406 in 1908, with $26,401,910 in 1907, with $24,362,668 in 1906, and with $24,054,182 in 1905. The imports of zinc were valued at $2,207,155 in 1909, against $753,461 in 1908, and $1,846,445 in 1907; the exports were valued at $1,222,173 in 1909, against $1,683,887 in 1908 and $1,401,831 in 1907.

Bauxite.—In 1909 the production of bauxite was 129,101 long tons, valued at $679,447, as compared with 52,167 long tons, valued at $263,968, in 1908; with 97,776 long tons, valued at $480,330, in 1907; with 75,332 long tons, valued at $368,311, in 1906; and with 48,129 long tons, valued at $240,292, in 1905. The imports for consumption in 1909 were 18,688 long tons, valued at $83,956, as against 21,679 long tons, valued at $87,823, in 1908, and 25,066 long tons, valued at $93,208, in 1907.

Aluminum.—The consumption of aluminum during 1909 was 34,210,000 pounds, valued at $6,575,000, as against 11,152,000 pounds, valued at $2,434,600 in 1908; 17,211,000 pounds, valued at $4,926,948 in 1907; 14,910,000 pounds, valued at $4,262,286 in 1906; and 11,347,000 pounds, valued at $3,246,300 in 1905. The imports of aluminum salts in 1909 were valued at $29,061, against $24,929 in 1908. The exports of manufactures of aluminum were valued at $567,375, against $330,092 in 1908.

Quicksilver.—The production of quicksilver during 1909 amounted to 21,075 flasks, as against 19,752 flasks in 1908, 21,567 flasks in 1907, 26,238 flasks in 1906, and 30,451 flasks in 1905. The value of the quicksilver produced in 1909 was $888,710, as compared with $824,146 in 1908, with $828,931 in 1907, with $958,634 in 1906, and with $1,103,120 in 1905. California reported 16,078 flasks, as against 16,984 flasks in 1908, 17,431 flasks in 1907, 20,310 flasks in 1906, and 24,635 flasks in 1905. Texas reported 4,188 flasks, as against 2,383 flasks in 1908, 3,686 flasks in 1907, 4,761 flasks in 1906, and 4,723 flasks in 1905. Utah did not report any production in 1909 or 1908, as against 450 flasks in 1907, and 1,164 flasks in 1906. Oregon and Nevada combined reported 809 flasks in 1909. Arizona had no production in 1909. Oregon and Arizona combined reported 386 flasks in 1908, as against no production in 1907, and 3 flasks from Oregon in 1906. The imports were valued at $8,203 in 1909 and at $8,216 in 1908; the exports at $266,243 in 1909, as against $124,960 in 1908.

Chromic iron ore.—California and Wyoming produced chromite commercially during 1909, the quantity being 598 long tons, valued at $8,300, as compared with the output in California alone of 359 long tons, valued at $7,230 in 1908; with 290 long tons, valued at $5,640 in 1907; with 107 long tons, valued at $1,800 in 1906; and with 22 long tons, valued at $375 in 1905. The imports in 1909 were 39,624 long tons, valued at $460,758, as against 27,876 long tons, valued at $345,960 in 1908, and 41,989 long tons, valued at $491,925 in 1907.

Molybdenum minerals.—No production of molybdenum was reported in 1908 or in 1909. There was a small commercial production in 1907 as in 1906 and 1905.

Nickel.—The production of nickel in 1908 and 1909 is included under unspecified products. There was no production of metallic nickel reported in 1907 as in 1906 and 1905, only a small quantity of nickel and colbalt ore being reported as sold. The imports of nickel in 1909 were valued at $3,036,273, as against $2,497,585 in 1908, $2,243,026 in 1907, and $1,902,367 in 1906; the exports in 1909 were valued at $4,101,976, as against $3,297,988 in 1908.

Titanium ore.—A production of rutile estimated at $10,000 was reported from Virginia in 1909; none was reported in 1908. There was a small output from Virginia in 1907.

Tungsten ore.—The commercial production of concentrated tungsten ores during 1909 amounted to 1,619 short tons, valued at $614 370 as against 671 short tons, valued at $229,955 in 1908; 1,640 short tons, valued at $890,048 in 1907; 928 short tons, valued at $348,867 in 1906; and 803 short tons, valued at $268,676 in 1905.

Uranium and vanadium minerals.—A small output of vanadium was reported from Colorado in 1909, but no uranium. No output of either was reported for 1908. The production in 1907, as in 1906, was included under unspecified products. The production in 1905 was valued at $375. Imports of uranium salts and oxide were valued at $12,057 in 1909, against $7,145 in 1908 and $8,619 in 1907.

Tantalum minerals.—No output of tantalum was reported in 1908; a very small production was reported from South Dakota in 1909, as in 1907.

Platinum.—The production of refined platinum from domestic ores in 1909 was 638 ounces, valued at $15,950, as compared with 750 ounces, valued at $14,250, in 1908; with 357 ounces, valued at $10,589, in 1907; with 1,439 ounces, valued at $45,189, in 1906; and with 318 ounces, valued at $5,320, in 1905. The average price per ounce for 1907 was $29.66; in 1908 it was $16.80, and in 1909 it was $24.98. The imports of platinum in 1909 were valued at $2,973,948, as against $1,229,873 in 1908, and $2,684,642 in 1907.

Iridium, osmium, palladium, and rhodium.—In 1909 imports of iridium, valued at $125,878, of osmium, valued at $1,569, and of palladium, valued at $13,416, were reported. The production of these metals from domestic ores in the United States is negligible.

Antimony.—There was no production of antimony reported in either 1908 or 1909. The production in 1907 was 351 short tons, valued at $77,300, as compared with 1,766 short tons, valued at $602,949, in 1906, and with 3,240 short tons, valued at $705,787, in 1905. The imports of antimony (metal, regulus, and ore) in 1909 were valued at $714,366, as against $878,136 in 1908 and $1,588,764 in 1907; imports of antimony salts in 1909 were valued at $60,353, as against $65,898 in 1908 and $98,038 in 1907.

Antimonial lead.—The output and value of antimonial lead are reported separately for the second time in this report. The production in 1909 was 12,896 short tons, valued at $1,231,019, as against 13,629 short tons, valued at $1,264,771, in 1908, and 9,910 short tons, valued at $1,322,985, in 1907.

Bismuth.—The only production of bismuth in 1909 was at Grasselli, Ind., and may not be disclosed. There was a small production of bismuth in 1908; no production was reported in 1907. The marketed production of bismuth ore in 1906 was 8,334 pounds, valued at $12,500, and in 1905 it was 24,405 pounds, valued at $4,187. The imports in 1909 were valued at $286,516, as against $257,397 in 1908 and $325,015 in 1907.

Tin.—A small production of metallic tin was reported from South Dakota in 1909, valued at $4,832. A few tons of stream tin were produced from Buck Creek, Alaska, and were shipped to Penzance, England—as to Hamburg, Germany, in 1908. There was a very small production of metallic tin in South Dakota in 1907, which, with concentrates from Alaska, from South Dakota, and from the North Carolina-South Carolina deposits, was valued at $33,285, against $35,600 in 1906. The imports of tin in 1909 were valued at $27,558,546, as against $23,923,560 in 1908 and $32,074,263 in 1907.

Cadmium.—Cadmium was produced by the Grasselli Chemical Co., of Cleveland, Ohio, in 1906; there was a small production also in 1907, 1908, and 1909. The imports of cadmium were valued at $4,559 in 1909, at $2,390 in 1908, at $1,633 in 1907, and at $10,522 in 1906.

Selenium and tellurium.—There was a small output of selenium in 1909. Selenium is recovered in the anode mud or slimes of the electrolytic copper refineries, particularly at Baltimore, Md., and at Perth Amboy and Chrome, N. J., but no commercial output has been reported. Tellurium is found combined in large quantities with gold and silver at Cripple Creek, Colo., in smaller quantities at other mining camps of the West, and also in the mud or slimes of electrolytic copper refineries.

FUELS.

Coal.—For the fourth time in the history of the United States, the production of coal reached in 1909 a total of over 400,000,000 short tons. The output fell from 480,363,424 tons of 2,000 pounds, valued at $614,798,898, in 1907, to 415,842,698 short tons, valued at $532,314,117, in 1908, and increased to 460,803,416 short tons, valued at $554,902,624, in 1909—an increase in 1909 over 1908 of 44,960,718 short tons, or 10.8 per cent, in quantity and of $22,588,507, or 4.2 per cent, in value. Of this total, the output of anthracite coal in 1909 amounted to 72,374,249 long tons (or 81,059,159 short tons) as compared with 74,347,102 long tons (equivalent to 83,268,754 short tons) in 1908, a decrease of 1,972,853 long tons (or 2,209,595 short tons). The value of anthracite coal at the mines in 1909 was $149,415,847 as against $158,178,849 in 1908, $163,584,056 in 1907, $131,917,694 in 1906, and $141,879,000 in 1905—a decrease in 1909 as compared with 1908 of $8,763,002. The average price of the anthracite coal actually sold during the 1909 season at the mine was $2.06 per long ton as against $2.13 per long ton in 1908.

The output of bituminous coal (which includes semianthracite and all semibituminous and lignite coals) amounted in 1909 to 379,744,257 short tons, valued at $405,486,777, as compared with 332,573,944 short tons, valued at $374,135,268, in 1908; with 394,759,112 short tons, valued at $451,214,842, in 1907; with 342,874,867 short tons, valued at $381,162,115, in 1906; and with 315,062,785 short tons, valued at $334,658,294, in 1905. The increase in the production of bituminous coal in 1909 from 1908 was therefore 47,170,313 short tons, or 14.2 per cent, in quantity and $31,351,509, or 8.4 per cent, in value. The average price of bituminous coal per ton at the mines in 1909 was $1.07, as against $1.12 in 1908, $1.14 in 1907, $1.11 in 1906, $1.06 in 1905, $1.10 in 1904, and $1.24 in 1903—the highest price recorded by the Survey. The imports of anthracite in 1909 were valued at $12,918, against $73,778 in 1908, and $40,971 in 1907; the imports of bituminous were valued at $3,628,533, against $3,964,843 in 1908, and $5,397,222 in 1907. The exports were, in 1909, anthracite, $14,141,468; bituminous, $24,300,050; 1908, anthracite, $13,524,595; bituminous, $23,361,914; 1907, anthracite, $13,217,985; bituminous, $26,972,908.

Coal briquets.—The production of coal briquets in the United States in 1909 was 139,661 short tons, valued at $452,697, as compared with 90,358 short tons, valued at $323,057, in 1908, and with 66,524 short tons, valued at $258,426, in 1907.

Coke.—The production of coke in 1909 amounted to 39,315,065 short tons (6,254,644 tons from retort ovens), valued at $89,065,483, as against 26,033,518 short tons (4,201,226 tons from retort ovens), valued at $62,483,983, in 1908; 40,779,564 tons, valued at $111,539,126, in 1907; and 36,401,217 tons, valued at $91,608,034, in 1906. The average price per ton in 1909 was $2.29, against $2.40 in 1908 and $2.74 in 1907. The average output from the by-product ovens in 1909 was 1,598 short tons per oven, against 1,142 tons per oven in 1908 and 1,472 tons per oven in 1907; the average output from beehive ovens in 1909 was 361 short tons per oven, against 258 tons in 1908 and 386.8 tons in 1907. The imports of coke were valued at $736,120 in 1909, against $606,294 in 1908, and $596,366 in 1907; the exports were valued at $3,232,673 in 1909, against $2,161,032 in 1908 and $3,206,793 in 1907.

Gas, coke, tar, and ammonia.—No report on the production of gas, coke, tar, and ammonia was prepared for 1909. The aggregate value of all the products obtained from the distillation of coal in gas works and retort ovens in 1905 was $56,684,972, as against $51,157,736 in 1904 and $47,837,600 in 1903. No report was prepared for 1906. The aggregate value in 1907 was $73,573,004; in 1908 it was $64,660,040. The imports of ammonium sulphate in 1908 were valued at $2,036,270, as against $1,915,908 in 1907. The imports of coal-tar products in 1909 were valued at $9,831,476, as against $7,044,585 in 1908 and $8,846,401 in 1907.

Natural gas.—The value of the natural gas produced in 1909 was $63,206,941, as compared with $54,640,374 in 1908, with $54,222,399 in 1907, with $46,873,932 in 1906, and with $41,562,855 in 1905. The imports of natural gas in 1909 were valued at $6,060 against $22,003 in 1908 and $32,107 in 1907.

Petroleum.—The total production of crude petroleum in the United States in 1909 was 182,134,274 barrels, as against 178,527,355 barrels in 1908, 166,095,335 barrels in 1907, 126,493,936 in 1906, and 134,717,580 in 1905—an increase in 1909 of 3,606,919 barrels, or 2.02 per cent, over the production of 1908. Among the noteworthy changes in production in 1909 were gains, as compared with 1908, of 21 per cent, 24 per cent, and 12 per cent, respectively, in California, Oklahoma, and West Virginia, and losses of over 30 per cent, 47 per cent, and 14 per cent, respectively, in Indiana, Louisiana, and Texas. The value of crude petroleum produced during 1909 was $128,248,783, or 70.4 cents per barrel, as against $129,079,184 in 1908 and $120,106,749 in 1907, or 72.3 cents per barrel in both years; against $92,444,735, or 73.1 cents per barrel, in 1906; and against $84,157,399, or 62.47 cents per barrel, in 1905. The imports of petroleum in 1909 were valued at $276,459, as against $617,659 in 1908 and $286,252 in 1907; the exports in 1909 amounted to $103,838,590, as against $108,815,055 in 1908 and $91,283,064 in 1907.

The imports of ozokerite and paraffin in 1909 were valued at $1,422,126, as against $438,628 in 1908 and $186,182 in 1907; the exports of paraffin and paraffin wax were valued in 1909 at $7,608,624, as against $6,922,638 in 1908 and $10,209,448 in 1907.

Peat.—The commercial consumption, including production and imports, of peat in 1909 in the forms of peat fertilizer filler, peat fuel, and peat moss litter was valued at $174,269, as against $133,000 in 1908. It would seem that the conversion of raw bog peat into these three commercial forms is now to be reported as an established industry in this country. The imports of peat moss litter have averaged about $45,000 for the last four years.

STRUCTURAL MATERIALS.

Cement.—The total production of hydraulic cement in the United States in 1909 was 65,399,889 barrels, valued at $52,797,973, as compared with 52,910,925 barrels, valued at $44,477,653, in 1908; with 52,230,342 barrels, valued at $55,903,851, in 1907; with 51,000,445 barrels, valued at $55,302,277, in 1906; and with 40,102,308 barrels, valued at $35,931,533, in 1905. The Portland cement production in 1909 was 63,701,605 barrels, valued at $52,045,764, as compared with 51,072,612 barrels, valued at $43,547,679, in 1908; with 48,785,390 barrels, valued at $53,992,551, in 1907; with 46,463,424 barrels, valued at $52,466,186, in 1906; and with 35,246,812 barrels, valued at $33,245,867, in 1905. The production of natural cement in 1909 was 1,537,638 barrels, valued at $652,756, as compared with 1,686,682 barrels, valued at $834,509, in 1908; with 2,887,700 barrels, valued at $1,467,302, in 1907; with 4,055,797 barrels, valued at $2,423,170, in 1906; and with 4,473,049 barrels, valued at $2,413,052, in 1905. The production of puzzolan cement in 1909 amounted to 160,646 barrels, valued at $99,453, as against 151,451 barrels, valued at $95,468, in 1908; 557,252 barrels, valued at $443,998, in 1907; 481,224 barrels, valued at $412,921, in 1906; and 382,447 barrels, valued at $272,614, in 1905. The imports of hydraulic cement in 1909 were valued at $627,116, as compared with $1,206,832 in 1908 and $2,614,228 in 1907; the exports were valued at $1,417,534 in 1909, against $1,249,229 in 1908 and $1,450,841 in 1907.

Clay products.—The value of all clay products in 1909, as reported to this office, was $166,321,213, as against $133,197,762 in 1908, $158,942,369 in 1907, $161,032,722 in 1906, and $149,697,188 in 1905. The brick and tile products in 1909 were valued at $135,271,772, as compared with $108,062,207 in 1908, with $128,798,895 in 1907, $129,591,838 in 1906, and $121,778,294 in 1905. The pottery products were valued at $31,049,441 in 1909, as against $25,135,555 in 1908, $30,143,474 in 1907, $31,440,884 in 1906, and $27,918,894 in 1905. The imports of pottery in 1909 amounted to $10,607,212, as against $10,522,791 in 1908 and $13,585,612 in 1907. The imports of brick were valued at $189,536, against $162,341 in 1908 and $225,320 in 1907. The exports of brick in 1909 were valued at $1,149,892, and the exports of pottery at $863,695. The imports of kaolin or china clay in 1909 were valued at $1,505,779, as against $1,129,847 in 1908 and $1,582,893 in 1907. The imports of other clays amounted in 1909 to $290,011, as against $189,454 in 1908 and $337,539 in 1907.

Lime.—The production of lime in 1909 was 3,472,852 short tons, valued at $13,805,405, as against 2,766,873 short tons, valued at $11,191,186, in 1908; 3,092,524 short tons, valued at $12,656,705, in 1907; 3,198,087 short tons, valued at $12,480,653, in 1906; and 2,984,100 short tons, valued at $10,941,680, in 1905. The average price per short ton was $3.90 in 1906, $4.09 in 1907, $4.01 in 1908, and $3.98 in 1909. The imports in 1909 were 8,687 short tons, valued at $75,556, against 5,060 tons, valued at $28,952, in 1908. No exports were reported.

Sand and gravel.—The production of sand for molding, building, engine, furnace, and other uses and of gravel reported in 1909 was 58,461,100 short tons, valued at $17,173,615, as against 36,122,491 short tons, valued at $12,135,433, in 1908; 49,664,622 short tons, valued at $13,242,002, in 1907; 31,842,572 short tons, valued at $11,489,420, in 1906; and 22,144,633 short tons, valued at $10,115,915, in 1905. The imports of sand in 1909 were valued at $106,234, as compared with $77,574 in 1908.

Sand-lime brick.—The production of sand-lime brick in 1909 was valued at $1,150,580, as against $1,029,699 in 1908, $1,225,769 in 1907, $1,170,005 in 1906, and $972,064 in 1905.

Slate.—The production of slate in 1909 was valued at $5,441,418, as against $6,316,817 in 1908, $6,019,220 in 1907, $5,668,346 in 1906, and $5,496,207 in 1905. The imports of slate in 1909 were valued at $7,872, against $7,227 in 1908; the exports of roofing slate were valued in 1909 at $209,383; in 1908 the value was $197,216 and in 1907 it was $220,995.

Stone.—The value of all kinds of stone produced in the United States in 1909 amounted to $71,345,199, as compared with $65,712,499 in 1908, with $71,105,805 in 1907, $66,378,794 in 1906, and $63,798,748 in 1905. The imports of stone were valued in 1909 at $1,663,025, and the exports at $1,170,819, as against $1,483,026 and $1,003,251, respectively, in 1908.

Included under stone is the limestone used for fluxing in blast furnaces, which in 1909 was 15,772,863 long tons, valued at $7,921,807, as against 11,091,442 long tons, valued at $5,905,241, in 1908; 17,119,297 long tons, valued at $9,144,489, in 1907; 16,077,202 long tons, valued at $7,612,692, in 1906; and 15,387,891 long tons, valued at $7,004,265, in 1905.

ABRASIVE MATERIALS.

Artificial abrasives.—The total production of the artificial abrasives, alundum, carborundum, and crushed steel, in 1909 amounted to 20,468,000 pounds, valued at $1,365,820, as against 8,698,000 pounds, valued at $626,340, in 1908; 14,632,000 pounds, valued at $1,027,246, in 1907; and 11,774,300 pounds, valued at $777,081, in 1906.

Corundum and emery.—No domestic corundum was reported in 1909; the output of emery was 1,580 short tons, valued at $18,185. The combined production of corundum and emery in 1908 amounted to 669 short tons, valued at $8,745, as against 1,069 short tons, valued at $12,294, in 1907; 1,160 short tons, valued at $44,310, in 1906; and 2,126 short tons, valued at $61,464, in 1905. The imports in 1909 were valued at $338,997, in 1908 at $248,399, and in 1907 at $412,630.

Abrasive quartz and feldspar.—Abrasive quartz and abrasive feldspar are included under quartz and feldspar, respectively.

Garnet.—The production of abrasive garnet during 1909 amounted to 2,972 short tons, valued at $102,315, as against 1,996 short tons, valued at $64,620, in 1908; 7,058 short tons, valued at $211,686, in 1907; 4,650 short tons, valued at $157,000, in 1906; and 5,050 short tons, valued at $148,095, in 1905. The average price per ton was $34.43 in 1909, against $32.37 per ton in 1908 and $30 per ton in 1907.

Grindstones.—The total value of all kinds of grindstones and pulpstones produced during 1909 was $804,051, as against $536,095 in 1908, $896,022 in 1907, $744,894 in 1906, and $777,606 in 1905. The imports in 1909 were valued at $99,153; in 1908, at $80,382; in 1907, at $111,495.

Infusorial earth and tripoli.—The value of the infusorial earth and tripoli produced in 1909 was $122,346, as against $97,442 in 1908 and $104,406 in 1907. In 1906 the production of infusorial earth and tripoli amounted to 8,099 short tons, valued at $72,108, as against 10,977 short tons, valued at $64,637, in 1905, and 6,274 short tons, valued at $44,164, in 1904. The imports of rotten stone and tripoli in 1909 were valued at $24,024, against $17,252 in 1908 and $27,121 in 1907.

Millstones and burrstones.—The value of the production of millstones and burrstones in 1909 was $35,393, as against $31,420 in 1908, $31,741 in 1907, $48,590 in 1906, and $37,974 in 1905. The imports were valued at $22,590 in 1909, at $18,642 in 1908, and at $27,308 in 1907.

Oilstones and whetstones.—The production of oilstones and whetstones in 1909 was valued at $214,019, against $217,284 in 1908 and $264,188 in 1907. The imports were valued at $68,018 in 1909, at $44,304 in 1908, and at $89,939 in 1907.

Pumice.—The production of pumice amounted in 1909 to 15,103 short tons, valued at $33,439, as against 10,569 short tons, valued at $39,287, in 1908; 8,112 short tons, valued at $33,818, in 1907; 12,200 short tons, valued at $16,750, in 1906; and 1,832 short tons, valued at $5,504, in 1905. The imports were valued at $100,997 in 1909, at $67,094 in 1908, at $85,647 in 1907, and at $111,695 in 1906.

CHEMICAL MATERIALS.

Arsenious oxide.—The domestic production of arsenious oxide (white arsenic) in 1909 amounted to 2,428,313 pounds, valued at $52,946. That of 1908 (which could not be divulged) was considerably less in both quantity and value than the production of 1907, which was 3,502,000 pounds, valued at $163,000, as compared with 1,474,000 pounds, valued at $63,460, in 1906; and with 1,507,386 pounds, valued at $35,210, in 1905. The imports of white arsenic, metallic arsenic, and arsenic sulphide in 1909 were valued at $303,728, as against $430,400 in 1908 and $574,998 in 1907.

Borax.—The reported returns for 1909 gave an aggregate production of crude borax of 41,434 short tons, valued at $1,534,365, as compared with 25,000 short tons, valued at $975,000, in 1908; with 52,850 short tons, valued at $1,121,520, in 1907; 58,173 short tons, valued at $1,182,410, in 1906; and 46,334 short tons, valued at $1,019,154, in 1905. Only high-grade colemanite was worked in 1909, which accounts for higher valuation with lessened tonnage. The imports of borax in 1909 were valued at $11,687, as against $36,764 in 1908.

Bromine.—The production of bromine in 1909, including the bromine contained in potassium bromide, amounted to 728,875 pounds, valued at $92,735, as compared with 1,055,636 pounds, valued at $102,344, in 1908; with 1,379,496 pounds, valued at $195,281, in 1907; 1,283,250 pounds, valued at $165,204, in 1906; and with 1,192,758 pounds, valued at $178,914, in 1905.

Fluorspar and cryolite.—The commercial production of fluorspar in 1909 was 50,742 short tons, valued at $291,747, as compared with 38,795 short tons, valued at $225,998, in 1908; with 49,486 short tons, valued at $287,282, in 1907; with 40,796 short tons, valued at

$244,025, in 1906; and with 57,385 short tons, valued at $362,488, in 1905. It is estimated that the imports in 1908 amounted to about 22,000 short tons; 6,971 short tons, valued at $26,377, were reported as imported for consumption in 1909. The imports of cryolite in 1909 were reported as valued at $18,427, as against $16,445 in 1908 and $28,902 in 1907.

Gypsum.—The output of crude gypsum in 1909 was 2,252,785 short tons, valued in its first marketable condition at $5,906,738, as compared with 1,721,829 short tons, valued in its first marketable condition at $4,075,824, in 1908; with 1,751,748 short tons, valued at $4,942,264, in 1907; with 1,540,585 short tons, valued at $3,837,975, in 1906; and with 1,043,202 short tons, valued at $3,029,227, in 1905. The greatly increased production of late years is attributable to the largely increased use of wall plaster and of plaster of Paris in large modern buildings. The imports in 1909 were valued at $425,137, as against $354,403 in 1908.

Lithium minerals.—The production of lithium minerals in 1909 was small; in 1908 it was 203 short tons, valued at $1,550, as against 530 short tons, valued at $11,000, in 1907; 383 short tons, valued at $7,411, in 1906; and 79 short tons, valued at $1,412, in 1905.

Marls.—The production of marls in the United States in 1909 was 21,814 short tons, valued at $45,053, as compared with 8,469 short tons, valued at $4,330, in 1908; with 14,091 short tons, valued at $8,429, in 1907; 19,104 short tons, valued at $7,341, in 1906; and 38,026 short tons, valued at $16,494, in 1905. The output in 1909 was from New Jersey, New York, and South Carolina.

Phosphate rock.—The total commercial production of phosphate rock reported to the Survey in 1909 amounted to 2,330,152 long tons, valued at $10,772,120, as compared with 2,386,138 long tons, valued at $11,399,128, in 1908; with 2,265,343 long tons, valued at $10,653,558, in 1907; with 2,080,957 long tons, valued at $8,579,437, in 1906; and with 1,947,190 long tons, valued at $6,763,403, in 1905. The total quantity of phosphate rock reported as mined during 1909 was 2,444,437 long tons, as against 2,661,459 long tons mined in 1908, 2,356,486 long tons mined in 1907, 2,001,394 long tons mined in 1906, and 2,138,309 long tons mined in 1905. The imports for consumption of crude phosphate in 1909 were 9,983 long tons, valued at $99,060, as against 14,311 long tons, valued at $82,863, in 1908, and 25,745 long tons, valued at $164,343, imported in 1907. The exports were 1,020,556 long tons, valued at $7,644,368, against 1,188,411 long tons, valued at $9,294,009, in 1908, and 1,018,212 long tons, valued at $8,387,176, in 1907.

Salt.—The salt product includes salt in the form of brine used in large quantities for the manufacture of soda ash, sodium bicarbonate, caustic soda, and other sodium salts. The domestic production of salt in 1909 amounted to 30,107,646 barrels of 280 pounds, valued at $8,343,831, as compared with 28,822,062 barrels, valued at $7,553,632, in 1908; with 29,704,128 barrels, valued at $7,608,323, in 1907; with 28,172,380 barrels, valued at $6,658,350, in 1906; and with 25,966,122 barrels, valued at $6,095,922, in 1905. The imports in 1909 were valued at $437,827, against $444,690 in 1908. The exports in 1909 were valued at $269,273, against $202,338 in 1908.

Sulphur and pyrite.—The domestic production of sulphur in 1909 was 239,312 long tons, valued at $4,432,066, as against 369,444 long tons, valued at $6,668,215, in 1908; 293,106 long tons, valued at $5,142,850, in 1907; and 294,153 long tons, valued at $5,096,678, in 1906. The production of pyrite in 1909 was 247,070 long tons, valued at $1,028,157, as against 222,598 long tons, valued at $857,113, in 1908; 247,387 long tons, valued at $794,949, in 1907; and 261,422 long tons, valued at $931,305, in 1906. The combined production of sulphur and pyrite for the manufacture of sulphuric acid amounted in 1905 to 434,677 long tons, valued at $4,645,052, and in 1904 to 334,373 long tons, valued at $3,478,568. The production of domestic sulphur, chiefly from Louisiana, rose in value from $2,663,760 in 1904 to $6,668,215 in 1908 and fell to $4,432,066 in 1909. The imports of sulphur fell in value from $2,511,269 in 1904 to $362,379 in 1908 and rose to $549,632 in 1909. The exports in 1909 amounted to 37,142 long tons, valued at $736,928, against 27,894 long tons, valued at $561,534, in 1908. The exports exceeded the imports for consumption by about 10,000 tons in 1909 and by about 7,000 tons in 1908. Thus to-day this country is more than supplying its demand for sulphur, a thing regarded a few years ago as impossible. The imports of pyrite were valued at $2,428,580 in 1909 and $2,624,339 in 1908.

PIGMENTS.

Barytes.—The production of crude barytes in 1909 was 58,377 short tons, valued at $198,561, as compared with 38,527 short tons, valued at $120,442, in 1908; with 89,621 short tons, valued at $291,777, in 1907; with 50,231 short tons, valued at $160,367, in 1906; and with 48,235 short tons, valued at $148,803, in 1905. The imports of barytes fell from $173,425 in 1907 to $87,990 in 1908 and to $54,707 in 1909; the imports of barium compounds fell from $357,117 in 1907 to $319,114 in 1908 and rose to $399,376 in 1909.

Cobalt oxide.—The production of cobalt oxide in 1908 and 1909 is included under unspecified products. A production was reported from Oregon and Missouri in 1907. No production was reported in 1905 and 1906. The imports in 1909 were valued at $11,696, as against $17,077 in 1908 and $74,849 in 1907.

Mineral paints.—The commercial production of mineral paints in 1909 amounted to 79,688 short tons, valued at $2,419,710, as compared with 68,694 short tons, valued at $2,410,367, in 1908; with 71,973 short tons, valued at $2,979,158, in 1907; with 66,033 short tons, valued at $2,161,461, in 1906; and with 70,355 short tons, valued at $1,932,048, in 1905.

Zinc oxide.—The production of zinc oxide in 1909 amounted to 68,974 short tons, valued at $6,156,755, as compared with 56,292 short tons, valued at $5,072,460, in 1908; with 71,784 short tons, valued at $6,490,660, in 1907; with 74,680 short tons, valued at $5,999,375, in 1906; and with 68,603 short tons, valued at $5,520,240, in 1905. The imports of zinc oxide in 1909 were valued at $397,084, as against $297,674 in 1908; the exports were valued at $1,026,377, as against $845,070 in 1908, and $1,069,924 in 1907.

MISCELLANEOUS.

Asbestos.—The asbestos commercially produced in the United States in 1909 was obtained from deposits in Georgia and Vermont, with small quantities from Idaho and Wyoming. The total commercial production in 1909 was 3,085 short tons, valued at $62,603, as against 936 short tons, valued at $19,624, in 1908; 653 short tons, valued at $11,899, in 1907; 1,695 short tons, valued at $28,565, in 1906; and 3,109 short tons, valued at $42,975, in 1905. The imports for consumption were valued at $1,233,659 in 1909, as against $1,195,870 in 1908.

Asphalt.—Under this title are included the various bitumens or hydrocarbons not discussed elsewhere under the heading "Petroleum." The commercial production in 1909 was 228,655 short tons, valued at $2,138,273, as compared with 198,382 short tons, valued at $2,057,881, in 1908; with 223,861 short tons, valued at $2,826,489, in 1907; 138,059 short tons, valued at $1,290,340, in 1906; and 115,267 short tons, valued at $758,153, in 1905. The imports of asphalt in 1909 were valued at $633,205, as against $624,979 in 1908 and $645,464 in 1907. The exports for the fiscal year 1909 were valued at $425,420, as against $451,968 in the fiscal year 1908 and $374,476 in the fiscal year 1907.

Feldspar.—The production of feldspar in 1909 was 76,539 short tons, valued at $401,788, as against 70,474 short tons, valued at $428,553, in 1908, and 91,799 short tons, valued at $558,944, in 1907.

Fertilizers.—Fertilizers, including apatite, bone dust, guano, kieserite, and other manures, valued at $5,871,733, were imported in 1909, as against $1,893,732 imported in 1908 and $5,342,138 in 1907.

Fibrous talc.—This variety of talc, or soapstone, occurs in but one locality in the United States—Gouverneur, St. Lawrence County, N. Y. It is used principally as makeweight in the manufacture of paper. In 1909 the production was 48,536 short tons, valued at $359,957, as against 70,739 short tons, valued at $697,390, in 1908; 67,800 short tons, valued at $626,000, in 1907; 61,672 short tons, valued at $557,200, in 1906; and 56,500 short tons, valued at $445,000, in 1905.

Fuller's earth.—As reported to the Survey, the production of fuller's earth in 1909 was 33,486 short tons, valued at $301,604, as against 29,714 short tons, valued as $278,367, in 1908; 32,851 short tons, valued at $291,773, in 1907; 32,040 short tons, valued at $265,400, in 1906; and 25,178 short tons, valued at $214,497, in 1905. The imports were valued at $101,151 in 1909, at $93,413 in 1908, and at $122,221 in 1907.

Gems and precious stones.—The value of the gems and precious stones found in the United States in 1909 was reported as $534,380, as against $415,063 in 1908, $471,300 in 1907, $208,000 in 1906, and $326,350 in 1905. Pearls produced in 1907 were valued at $264,500, as against $381,000 in 1906. No production of pearls was reported for 1908 or 1909. Imports of precious stones in 1909 were valued at $40,237,509, against $13,700,404 in 1908, against $31,866,599 in 1907, and $43,602,476 in 1906.

Glass sand.—The production of glass sand in 1909 was 1,104,451 short tons, valued at $1,163,375, as against 1,093,553 short tons, valued at $1,134,599, in 1908; against 1,187,296 short tons, valued at $1,250,067, in 1907; against 1,089,430 short tons, valued at $1,208,788, in 1906; and 1,060,334 short tons, valued at $1,107,730, in 1905.

Graphite.—The commercial production of crystalline graphite during 1909 amounted to 6,294,400 pounds, valued at $313,271, as compared with 2,288,000 pounds, valued at $132,840, in 1908; with 4,947,840 pounds, valued at $171,149, in 1907; with 5,887,982 pounds, valued at $238,064, in 1906; and with 6,036,567 pounds, valued at $237,572, in 1905. The production of amorphous graphite in 1909 was 5,096 short tons, valued at $32,238, as compared with 1,443 short tons, valued at $75,250, in 1908; with 26,803 short tons, valued at $125,821, in 1907; with 16,853 short tons, valued at $102,175, in 1906; and with 21,953 short tons, valued at $80,639, in 1905. The production of artificial graphite in 1909 was 6,664,017 pounds, valued at $480,000, the average price being 7.2 cents per pound, as compared with 7,385,511 pounds, valued at $502,667, the average price being 6.8 cents per pound, in 1908; with 6,590,000 pounds, valued at $481,239, the average price being 7.3 cents per pound, in 1907; with 5,074,757 pounds, valued at $337,204, the average price being 6.64 cents per pound, in 1906; and with 4,591,550 pounds, valued at $313,980, the average price being 6.84 cents per pound, in 1905. The imports of graphite in 1909 were valued at $1,854,459, as against $762,367 in 1908, $1,777,389 in 1907, $1,554,212 in 1906, and $983,034 in 1905.

Magnesite.—The production of crude magnesite continues to be limited to California. During the year 1909 the commercial production was 9,465 short tons, valued at $37,860, as against 6,587 short tons, valued at $19,761, in 1908; 7,561 short tons, valued at $22,683, in 1907; 7,805 short tons, valued at $23,415, in 1906; and 3,933 short tons, valued at $15,221, in 1905. The imports of magnesite and magnesia in 1909 were valued at $1,041,418, as against $775,642 in 1908.

Mica.—The total production of mica in 1909 was 1,809,582 pounds of sheet mica, valued at $234,482, and 4,090 short tons of scrap mica, valued at $46,047, as against 972,964 pounds of sheet mica, valued at $234,021, and 2,417 short tons of scrap mica, valued at $33,904, in 1908; 1,060,182 pounds of sheet mica, valued at $349,311, and 3,025 short tons of scrap mica, valued at $43,800, in 1907; 1,423,100 pounds of sheet mica, valued at $252,248, and 1,489 short tons of scrap mica, valued at $22,742, in 1906; and 924,875 pounds of sheet mica, valued at $160,732, and 1,126 short tons of scrap mica, valued at $17,856, in 1905. The imports of mica in 1909 were valued at $618,813, as against $266,058 in 1908, and $925,259 in 1907.

Mineral waters.—The total production of mineral waters in 1909 was 64,674,486 gallons, valued at $6,894,134, as compared with 55,868,820 gallons, valued at $6,712,680, in 1908; 52,060,520 gallons, valued at $7,331,503, in 1907; and with 48,108,580 gallons, valued at $8,028,387, in 1906. The imports of mineral waters in 1909 were valued at $1,085,177, as against $1,033,047 in 1908.

Monazite and zircon.—The production of monazite is confined to North Carolina and South Carolina exclusively, more than half being obtained from the first-named State. In 1909 the production was 541,931 pounds of concentrates, valued at $65,032, as against 422,646 pounds of concentrates, valued at $50,718, in 1908; 548,152 pounds of concentrates, valued at $65,800, in 1907; and 847,275 pounds of concentrates (including about 1,100 pounds of zircon), valued at $152,560, in 1906. The imports of thorium nitrate in 1909 were 127,833 pounds, valued at $236,057, against 65,289 pounds, valued at $173,239, in 1908; against 51,441 pounds, valued at $152,666, in 1907. The imports of monazite and thorium oxide in 1909 were valued at $27,920; there were no imports reported in 1908 or in 1907.

The production of zircon in 1909 was 3,000 pounds, valued at $250.

Potassium salts.—There was no production of potassium salts reported in the United States in 1909, 1908, or 1907. The imports were valued in 1909 at $7,877,955, as against $5,623,752 in 1908, against $7,038,817 in 1907, and $5,491,217 in 1906.

Quartz.—The production of quartz in 1909 was 135,469 short tons, valued at $247,466, as compared with 47,316 short tons, valued at $190,157, in 1908, and with 33,192 short tons, valued at $223,801, in 1907. The value of the unground flint stones imported in 1909 was $301,547, as against $219,754 in 1908, and $288,371 in 1907.

Talc and soapstone.—Exclusive of the production of fibrous talc from Gouverneur, N. Y., the production of talc and soapstone in 1909 amounted to 81,802 short tons, valued at $862,002, as compared with 46,615 short tons, valued at $703.832, in 1908; with 72,010 short tons, valued at $905,047, in 1907; with 58,972 short tons, valued at $874,356, in 1906; and with 40,134 short tons, valued at $637,062, in 1905. The imports of talc in 1909 were valued at $56,287, as against $97,096, in 1908.

MINERAL PRODUCTION OF THE UNITED STATES IN 1908 AND 1909.

From the tabular statement headed "Mineral products of the United States in 1908 and 1909," including also the tables for the years 1880 to 1909, all unnecessary duplication has been excluded. The manufactured coke product, amounting in 1909 to 39,315,065 short tons, and valued at $89,965,483, is excluded, as the quantity and value of the coal used in its manufacture are included in the statistics of coal production. Similarly white lead, red lead, lithopone, Venetian red, litharge, and orange mineral, whose average aggregate value for the last ten years has largely exceeded $15,000,000, are not given in the table, the base from which they are made being included in the output of pig lead. Zinc white or zinc oxide, zinc-lead, sublimed blue lead, and sublimed white lead, on the other hand, made directly from the ores, and consequently not included in zinc or lead production, are tabulated. The production of pig iron and its value are given in the table as the best means of presenting the statistics of the production of iron in the first marketable condition, the value of iron ores being excluded. Similarly, the value of the products of the clay industries is given as being the first marketable condition of the greater part of the clay produced, although the production and value of the clay mined and sold in the raw state by clay miners to manufacturers of clay are elsewhere shown separately, but are not included in the tabular statement, in order to avoid duplication.

The figures for gold and silver for 1908 and 1909 are the official figures agreed upon by the United States Geological Survey and the Director of the Mint. The figures for the tonnage (not the value) of pig iron in 1908 and 1909 are from the reports of Mr. James M. Swank, general manager of the American Iron and Steel Association.

Mineral products of the United

	Product.	1908.	
		Quantity.	Value.
	METALS.		
1	Pig iron,[a] spot value[b] .... long tons[c]	15,936,018	$254,321,000
2	Silver, commercial value[d] .... troy ounces	52,440,800	28,050,600
3	Gold, coining value[e] .... do	4,574,340	94,560,000
4	Copper, value at New York City .... pounds	942,570,721	124,419,335
5	Lead[f], value at New York City .... short tons	310,762	26,104,008
6	Zinc[f], value at St. Louis .... do	190,749	17,930,406
7	Quicksilver, spot value .... flasks[g]	19,752	824,146
8	Aluminum .... pounds	[h] 11,152,000	2,434,600
9	Antimony[i] .... short tons	....	....
10	Antimonial lead .... do	13,629	1,264,771
11	Nickel[j], value at Philadelphia .... pounds	....	(k)
12	Tin .... do	(l)	....
13	Platinum, value at New York City .... troy ounces	750	14,250
14	Total value of metals	....	549,923,116
	NONMETALS (SPOT VALUE[b]).		
15	Bituminous coal[m] .... short tons	332,573,944	374,135,268
16	Pennsylvania anthracite .... long tons	74,347,102	158,178,849
17	Natural gas	....	54,640,374
18	Petroleum .... barrels[n]	178,527,355	129,079,184
19	Peat	....	133,000
20	Clay products[o]	....	133,197,762
21	Cement .... barrels[p]	52,910,925	44,477,653
22	Lime .... short tons	2,766,873	11,091,186
23	Sand, molding, building, etc., and gravel .... do	36,122,491	12,135,433
24	Sand-lime brick	....	1,029,699
25	Slate	....	6,316,817
26	Stone[q]	....	65,712,499
27	Corundum and emery .... short tons	669	8,745
28	Abrasive quartz and feldspar .... do	(r)	....
29	Garnet for abrasive purposes .... do	1,996	64,620
30	Grindstones	....	536,095
31	Infusorial earth and tripoli .... short tons	....	97,442
32	Millstones	....	31,420
33	Oilstones, etc	....	217,284
34	Pumice .... short tons	10,569	39,287
35	Arsenious oxide .... pounds	....	(k)
36	Borax (crude) .... short tons	25,000	975,000
37	Bromine .... pounds	1,055,636	102,344
38	Fluorspar .... short tons	38,785	225,998
39	Gypsum .... do	1,721,829	4,075,824
40	Lithium minerals .... do	203	1,550
41	Marls .... do	8,469	4,330
42	Phosphate rock .... long tons	2,386,138	11,399,124
43	Pyrite .... do	222,598	857,113
44	Sulphur .... do	369,444	6,668,215
45	Salt .... barrels[s]	28,822,062	7,553,632
46	Barytes (crude) .... short tons	38,527	120,442
47	Cobalt oxide .... pounds	....	(k)
48	Mineral paints[t] .... short tons	68,694	2,410,367
49	Zinc oxide .... do	56,292	5,072,460
50	Asbestos .... short tons	936	19,624

[a] Production of iron ore—1900: 27,553,161 long tons; value at mines, $66,590,504. 1901: 28,887,479 long tons; value at mines, $49,256,245. 1902: 35,554,135 long tons; value at mines, $65,412,950. 1903: 35,019,308 long tons; value at mines, $66,328,415. 1904: 27,644,330 long tons; value at mines, $43,186,741. 1905: 42,526,133 long tons; value at mines, $75,165,604. 1906: 47,749,728 long tons; value at mines, $100,597,106. 1907: 51,720,619 long tons; value at mines, $131,996,147. 1908: 35,983,336 long tons; value at mines, $81,845,904. 1909: 51,294,271 long tons; value at mines, $110,290,596. Statistics for iron ore and value of pig iron are collected by the Survey; statistics for pig iron output are furnished by the American Iron and Steel Association.

[b] By "spot" value is meant value at the point of production.

[c] Long tons are tons of 2,240 avoirdupois pounds; short tons are tons of 2,000 avoirdupois pounds.

[d] Average price per troy ounce in 1906 was 67 cents; in 1907 it was 66 cents; in 1908, 53 cents; in 1909, 52 cents.

[e] Prior to 1905, coining value, $20.6718 per troy ounce; in 1905, coining value, $20.671834; since 1905, coining value, $20.671834625323.

[f] The product from domestic ores only.

[g] Of 76½ avoirdupois pounds net; of 75 avoirdupois pounds net since June, 1904.

[h] Consumption in 1904, 1905, 1906, 1907, 1908, and 1909.

[i] Includes antimony smelted from imported ores, and also antimony contained in hard lead, except in 1907, 1908, and 1909.

[j] Includes nickel in copper-nickel alloy and in exported ore and matte.

[k] Includes nitrate of soda, carbonate of soda, sulphate of soda, and alum clays used by paper manufacturers; and bismuth, cadmium, columbite, lithium, nickel and cobalt, selenium, and vanadium, valued together in 1909 at $273,645.

States in 1908 and 1909.

1909.		Increase (+) or decrease (−) in 1909.		Percentage of increase (+) or decrease (−) in 1909.		
Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
25,795,471	$419,175,000	+ 9,859,453	+$164,854,000	+ 61.84	+ 64.82	1
54,721,500	28,455,200	+ 2,280,700	+ 404,600	+ 4.35	+ 1.44	2
4,821,701	99,673,400	+ 247,361	+ 5,113,400	+ 5.41	+ 5.41	3
1,092,951,624	142,083,711	+150,380,903	+ 17,664,376	+ 15.96	+ 14.20	4
354,188	30,460,168	+ 43,426	+ 4,356,160	+ 13.97	+ 16.68	5
230,225	24,864,300	+ 39,476	+ 6,933,894	+ 20.69	+ 38.67	6
21,075	888,710	+ 1,323	+ 64,564	+ 6.70	+ 7.83	7
[h] 34,210,000	6,575,000	+ 23,058,000	+ 4,140,400	+206.76	+170.00	8
						9
12,896	1,231,019	− 733	− 33,752	− 5.38	− 2.67	10
....	(k)	....	....	....	....	11
....	[l] 4,832	....	+ 4,832	....	....	12
638	15,950	− 112	+ 1,700	− 14.93	+ 11.92	13
....	753,427,290	....	+ 203,504,174	....	+ 37.10	14
379,744,257	405,486,777	+ 47,170,313	+ 31,351,509	+ 14.18	+ 8.38	15
72,374,249	149,415,847	− 1,972,853	− 8,763,002	− 2.65	− 5.54	16
....	63,206,941	....	+ 8,566,567	....	+ 15.68	17
182,134,274	128,248,783	+ 3,606,919	− 830,401	+ 2.02	− 0.64	18
....	174,269	....	+ 41,269	....	+ 31.02	19
....	166,321,213	....	+ 33,123,451	....	+ 24.87	20
65,399,889	52,797,973	+ 12,488,964	+ 8,320,320	+ 23.60	+ 18.71	21
3,472,852	13,805,405	+ 705,979	+ 2,714,219	+ 25.50	+ 24.00	22
58,461,100	17,173,615	+ 22,338,609	+ 5,038,182	+ 61.84	+ 41.52	23
....	1,150,580	....	+ 120,881	....	+ 11.74	24
....	5,441,418	....	− 875,399	....	− 13.86	25
....	71,345,199	....	+ 5,632,700	....	+ 8.57	26
1,580	18,185	+ 911	+ 9,440	+136.17	+107.94	27
(r)	....	....	....	....	....	28
2,972	102,315	+ 976	+ 37,695	+ 48.89	+ 58.33	29
....	804,051	....	+ 267,956	....	+ 50.00	30
....	122,348	....	+ 24,906	....	+ 25.56	31
....	35,393	....	+ 3,973	....	+ 12.64	32
....	214,019	....	− 3,265	....	− 1.50	33
15,103	33,439	+ 4,534	− 5,848	+ 42.90	− 14.88	34
2,428,000	52,946	....	+ 52,946	....	....	35
41,434	1,534,365	+ 16,434	+ 559,365	+ 65.74	+ 57.40	36
728,875	92,735	− 326,761	− 9,609	− 30.95	− 9.38	37
50,742	291,747	+ 11,957	+ 65,749	+ 30.83	+ 29.09	38
2,252,785	5,906,738	+ 530,956	+ 1,830,914	+ 31.00	+ 44.90	39
....	(k)	....	− 1,550	....	....	40
21,814	45,053	+ 13,345	+ 40,723	+157.57	+940.48	41
2,330,152	10,772,120	− 55,986	− 627,004	− 1.65	− 5.50	42
247,070	1,028,157	+ 24,472	+ 171,044	+ 10.99	+ 19.95	43
239,312	4,432,066	− 130,132	− 2,236,149	− 35.22	− 33.53	44
30,107,646	8,343,831	+ 1,285,584	+ 790,199	+ 4.46	+ 10.46	45
58,377	198,561	+ 19,850	+ 78,119	+ 51.50	+ 64.80	46
....	(k)	....	....	....	....	47
79,688	2,419,710	+ 10,994	+ 9,343	+ 16.00	+ .38	48
68,974	6,156,755	+ 12,682	+ 1,084,295	+ 22.52	+ 21.38	49
3,085	62,603	+ 2,149	+ 42,979	+229.59	+219.01	50

[l] Nineteen short tons of high-grade concentrates shipped to England from South Carolina in 1903. In 1904 about 142 short tons of concentrates from South Carolina, South Dakota, and Alaska shipped to England. In 1905 no production. In 1906, 2,500 pounds of metallic tin, 55 short tons of concentrates from Alaska, and 14 short tons of concentrates from North Carolina and South Carolina. In 1907 about 89 short tons of concentrates. In 1908, no production. In 1909 about 17 short tons of stream tin from Alaska were shipped to England.

[m] Including brown coal and lignite and anthracite mined elsewhere than in Pennsylvania. Coke—1902: 25,401,730 short tons; value at ovens, $63,339,167. 1903: 25,274,281 short tons; value at ovens, $66,498,664. 1904: 23,661,106 short tons; value at ovens, $46,144,941. 1905: 32,231,129 short tons; value at ovens, $72,476,196. 1906: 36,401,217 short tons; value at ovens, $91,608,034. 1907: 40,779,564 short tons; value at ovens, $111,539,126. 1908: 26,033,518 short tons; value at ovens, $62,483,983. 1909: 39,315,065 short tons; value at ovens, $89,965,483.

[n] Of 42 gallons.

[o] Value of clay mined and sold as unmanufactured clay. 1900: $1,840,377. 1901: $2,576,932. 1902: $2,061,072. 1903: $2,594,042. 1904: $2,320,162. 1905: $2,768,006. 1906: $3,245,256. 1907: $3,448,548. 1908: $2,599,986. 1909: $3,449,707.

[p] Of 380 pounds net.

[q] Includes limestone for iron flux, but not grindstones.

[r] Included under feldspar and quartz.

[s] Of 280 pounds net. Value is for net product exclusive of cost of packages.

[t] Includes since 1904 metallic paint, mortar colors, ocher, umber, sienna, shale, ground slate, sublimed blue lead, sublimed white lead, and zinc lead.

Mineral products of the United

	Product.	1908.	
		Quantity.	Value.
	NONMETALS (SPOT VALUE)—continued.		
51	Asphalt.....short tons..	198,382	$2,057,881
52	Bauxite.....long tons..	52,167	263,968
53	Chromic iron ore.....do....	359	7,230
54	Feldspar.....short tons..	70,474	428,553
55	Fuller's earth.....do....	29,714	278,367
56	Gems and precious stones.....	....	415,063
57	Glass sand.....short tons..	1,093,553	1,134,599
58	Graphite, crystalline.....pounds..	2,288,000	132,840
	Graphite, amorphous.....short tons..	1,443	75,250
59	Magnesite.....do....	6,587	19,761
60	Manganese ores.....long tons..	6,144	62,779
61	Manganiferous ores.....do....	55,620	132,556
62	Mica, sheet.....pounds..	972,964	234,021
	Mica, scrap.....short tons..	2,417	33,904
63	Mineral waters.....gallons sold..	55,868,820	6,712,680
64	Quartz.....short tons..	47,316	190,157
65	Talc and soapstone.....do....	46,615	703,832
66	Talc, fibrous.....do....	70,739	697,390
67	Thorium minerals (monazite) and zircon.....pounds..	422,646	50,718
68	Titanium ores (rutile).....do....	....	....
69	Tungsten ores.....short tons..	671	229,955
70	Uranium and vanadium minerals.....do....	....	....
71	Total value of nonmetals.....	....	1,044,470,144
72	Total value of metals.....	....	549,923,116
73	Estimated value of mineral products unspecified (a).....	....	250,000
74	Grand total.....	....	1,594,643,260

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[a] Includes nitrate of soda, carbonate of soda, sulphate of soda, and alum clays used by paper manufacturers; and bismuth, cadmium, columbite, lithium, nickel and cobalt, selenium, valued together in 1909 at $273,645.

States in 1908 and 1909—Continued.

1909.		Increase (+) or decrease (−) in 1909.		Percentage of increase (+) or decrease (−) in 1909.		
Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
228,655	$2,138,273	+ 30,276	+ $80,392	+ 15.26	+ 3.91	51
129,101	679,447	+ 76,934	+ 415,479	+147.48	+157.40	52
598	8,300	+ 239	+ 1,070	+ 66.57	+ 14.79	53
76,539	401,788	+ 6,065	− 26,765	+ 8.61	− 6.24	54
33,486	301,604	+ 3,772	+ 23,237	+ 12.69	+ 8.35	55
....	534,380	....	+ 119,317	....	+ 28.75	56
1,104,451	1,163,375	+ 10,898	+ 28,776	+ .99	+ 2.54	57
6,294,400	313,271	+ 4,006,400	+ 180,431	+175.10	+135.83	58
5,096	32,238	+ 3,653	− 43,012	+253.15	− 57.16	
9,465	37,860	+ 2,878	+ 18,099	+ 43.69	+ 91.59	59
1,544	19,675	− 4,600	− 43,104	−297.92	− 68.66	60
68,654	215,925	+ 13,034	+ 83,369	+ 23.43	+ 62.89	61
1,809,582	234,482	+ 836,618	+ 461	+ 85.99	+ .19	62
4,090	46,047	+ 1,673	+ 12,143	+ 69.22	+ 35.82	
64,674,486	6,894,134	+ 8,805,666	+ 181,454	+ 15.76	+ 2.70	63
135,469	249,466	+ 88,153	+ 59,309	+186.31	+ 31.19	64
81,802	862,002	+ 35,187	+ 158,170	+ 75.48	+ 22.47	65
48,536	359,957	− 22,203	− 337,433	− 31.00	− 93.74	66
543,931	65,282	+ 121,285	+ 14,564	+ 28.70	+ 28.72	67
....	10,000	....	+ 10,000	....	....	68
1,619	614,370	+ 948	+ 384,415	+141.28	+167.17	69
....	(*a*)	....	....	....	....	70
....	1,132,417,033	....	+ 87,946,889	....	+ 8.42	71
....	753,427,290	....	+ 203,504,174	....	+ 37.10	72
....	300,000	....	+ 50,000	....	+ 20.00	73
....	1,886,144,323	....	+ 291,501,063	....	+ 18.28	74

Mineral products of the United States

	Product.	1880.	
		Quantity.	Value.
	METALLIC.		
1	Pig iron, value at Philadelphia....long tons..	3,375,912	$89,315,569
2	Silver, commercial value....troy ounces..	30,318,700	34,717,000
3	Gold, coining value....do....	1,741,500	36,000,000
4	Copper, value at New York City....pounds..	60,480,000	11,491,200
5	Lead, value at New York City....short tons..	97,825	9,782,500
6	Zinc, value at New York City....do....	23,239	2,277,432
7	Quicksilver, value at San Francisco....flasks..	59,926	1,797,780
8	Nickel, value at Philadelphia....pounds..	233,893	257,282
9	Aluminum, value at Pittsburg....do....	....	....
10	Antimony, value at San Francisco....short tons..	50	10,000
11	Platinum (crude), value at San Francisco....troy ounces..	100	400
12	Total value of metallic products....	....	185,649,163
	NONMETALLIC (SPOT VALUES).		
13	Bituminous coal....short tons..	38,242,641	53,443,718
14	Pennsylvania anthracite....long tons..	25,580,189	42,196,678
15	Stone....	....	18,356,055
16	Petroleum....barrels..	26,286,123	24,183,233
17	Lime....do....	28,000,000	19,000,000
18	Natural gas....	....	....
19	Cement....barrels..	2,072,943	1,852,707
20	Salt....do....	5,961,060	4,829,566
21	Phosphate rock....long tons..	211,377	1,123,823
22	Limestone for iron flux....do....	4,500,000	3,800,000
23	Mineral waters....gallons sold..	2,000,000	500,000
24	Zinc white....short tons..	10,107	763,738
25	Potters' clay....do....	28,877	200,457
26	Mineral paints....do....	3,604	135,840
27	Borax....pounds..	3,692,443	277,233
28	Gypsum....short tons..	90,000	400,000
29	Grindstones....	....	500,000
30	Fibrous talc....short tons..	4,210	54,730
31	Pyrite....long tons..	2,000	5,000
32	Soapstone....short tons..	8,441	66,665
33	Manganese ores....long tons..	5,761	86,415
34	Asphalt....short tons..	444	4,440
35	Precious stones....	....	100,000
36	Bromine....pounds..	404,690	114,752
37	Corundum....short tons..	1,044	29,280
38	Barytes (crude)....do....	20,000	80,000
39	Graphite....pounds..	....	49,800
40	Millstones....	....	200,000
41	Oilstones, etc.[a]....pounds..	420,000	8,000
42	Marls....short tons..	1,000,000	500,000
43	Flint....long tons..	20,000	80,000
44	Fluorspar....short tons..	4,000	16,000
45	Chromic iron ore....long tons..	2,288	27,808
46	Infusorial earth....short tons..	1,833	45,660
47	Feldspar....long tons..	12,500	60,000
48	Mica....pounds..	81,669	127,825
49	Cobalt oxide....do....	7,251	24,000
50	Slate ground as a pigment....short tons..	1,000	10,000
51	Sulphur....do....	600	21,000
52	Asbestos....do....	150	4,312
53	Rutile....pounds..	100	400
54	Lithographic stone....short tons..	....	....
55	Total value of nonmetallic mineral products....	....	173,279,135
56	Total value of metallic products....	....	185,649,163
57	Estimated value of mineral products unspecified....	....	6,000,000
58	Grand total....	....	364,928,298

[a] Prior to 1889 quantity and value are for rough stone quarried; since 1890 they are for finished product.

for the calendar years 1880–1909.

1881.		1882.		1883.		
Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
4,144,254	$87,029,334	4,623,323	$106,336,429	4,595.510	$91,910,200	1
33,257,800	37,657,500	36,196,900	41,105,900	35,732,800	39,618,400	2
1,678,612	34,700,000	1,572,187	32,500,000	1,451,250	30,000,000	3
71,680,000	12,175,600	91,646,232	16,038,091	117,151,795	18,064,807	4
117,085	11,240,160	132,890	12,624,550	143,957	12,322,719	5
26,800	2,680,000	33,765	3,646,620	36,872	3,311,106	6
60,851	1,764,679	52,732	1,487,042	46,725	1,253,632	7
265,668	292,235	281,616	309,777	58,800	52,920	8
....	....	....	....	83	875	9
50	10,000	60	12,000	60	12,000	10
100	400	200	600	200	600	11
....	187,549,908	....	214,061,009	....	196,547,259	12
48,179,475	60,224,344	60,361,190	76,076,487	68,531,500	82,237,800	13
28,500,016	64,125,036	31,358,264	70,556,094	34,336,469	77,257,055	14
....	20,000,000	....	21,000,000	....	20,000,000	15
27,661,238	25,448,339	30,510,830	24,065,988	23,449,633	25,790,252	16
30,000,000	20,000,000	31,000,000	21,700,000	32,000,000	19,200,000	17
....	....	....	215,000	....	475,000	18
2,500,000	2,000,000	3,250,000	3,672,750	4,190,000	4,293,500	19
6,200,000	4,200,000	6,412,373	4,320,140	6,192.231	4,211,042	20
266,734	1,980,259	332,077	1,992,462	378,380	2,270,280	21
6,000,000	4,100,000	3,850,000	2,310,000	3,814,273	1,907,136	22
3,700,000	700,000	5,000,000	800,000	7,529,423	1,119,603	23
10,000	700,000	10,000	700,000	12,000	840,000	24
28,000	200,000	33,600	240,000	35,840	250,000	25
6,000	100,000	7,000	105,000	7,000	84,000	26
4,046,000	304,461	4,236,291	338,903	6,500,000	585,000	27
85,000	350,000	100,000	450,000	90,000	420,000	28
....	500,000	....	700,000	....	600,000	29
5,000	60,000	6,000	75,000	6,000	75,000	30
10,000	60,000	12,000	72,000	25,000	137,500	31
7,000	75,000	6,000	90,000	8,000	150,000	32
4,895	73,425	4,532	67,980	6,155	92,325	33
2,000	8,000	3,000	10,500	3,000	10,500	34
....	110,000	....	150.000	....	207,050	35
300,000	75,000	250,000	75,000	301,100	72,264	36
500	80,000	500	80,000	550	100,000	37
20,000	80,000	20,000	80,000	27,000	108,000	38
400,000	30,000	425,000	34,000	575,000	46,000	39
....	150,000	....	200,000	....	150,000	40
500,000	8,580	600,000	10,000	600,000	10,000	41
1,000,000	500,000	1,080,000	540,000	972,000	486,000	42
25,000	100,000	25,000	100,000	25,000	100,000	43
4,000	16,000	4,000	20,000	4,000	20,000	44
2,000	30,000	2,500	50,000	3,000	60,000	45
1,000	10,000	1,000	8,000	1,000	5,000	46
14,000	70,000	14,000	70,000	14,100	71,112	47
100,000	250,000	100,000	250,000	114,000	285,000	48
8,280	25,000	11,653	32,046	1,096	2,795	49
1,000	10,000	2,000	24,000	2,000	24,000	50
600	21,000	600	21,000	1,000	27,000	51
200	7,000	1,200	36,000	1,000	30,000	52
200	700	500	1,800	550	2,000	53
50	1,000	....	....	....	....	54
....	206,783,144	....	231,340,150	....	243,812,214	55
....	187,549,908	....	214,061,009	....	196,547,259	56
....	6,500,000	....	6,500,000	....	6,500,000	57
....	400,833,052	....	451,901,159	....	446,859,473	58

Mineral products of the United States for

	Product.	1884.	
		Quantity.	Value.
	METALLIC.		
1	Pig iron, value at Philadelphia .... long tons..	4,097,868	$73,761,624
2	Silver, commercial value .... troy ounces..	37,743,800	41,921,300
3	Gold, coining value .... do....	1,489,950	30,800,000
4	Copper, value at New York City .... pounds..	145,221,934	17,789,687
5	Lead, value at New York City .... short tons..	139,897	10,537,042
6	Zinc, value at New York City .... do....	38,544	3,422,707
7	Quicksilver, value at San Francisco .... flasks..	31,913	936,327
8	Nickel, value at Philadelphia .... pounds..	64,550	48,412
9	Aluminum, value at Pittsburg .... do....	150	1,350
10	Antimony, value at San Francisco .... short tons..	60	12,000
11	Platinum (crude), value at San Francisco .... troy ounces..	150	450
12	Total value of metallic products	....	179,230,899
	NONMETALLIC (SPOT VALUES).		
13	Bituminous coal .... short tons..	73,730,539	77,417,066
14	Pennsylvania anthracite .... long tons..	33,175,756	66,351,512
15	Stone	....	19,000,000
16	Petroleum .... barrels..	24,218,438	20,595,966
17	Lime .... do....	37,000,000	18,500,000
18	Natural gas	....	1,460,000
19	Brick clay	....	....
20	Clay (all other than brick) .... short tons..	39,200	270,000
21	Cement .... barrels..	4,000,000	3,720,000
22	Salt .... do....	6,514,937	4,197,734
23	Phosphate rock .... long tons..	431,779	2,374,784
24	Limestone for iron flux .... do....	3,401,930	1,700,965
25	Mineral waters .... gallons sold..	10,215,328	1,459,143
26	Zinc white .... short tons..	13,000	910,000
27	Mineral paints .... do....	7,000	84,000
28	Borax .... pounds..	7,000,000	490,000
29	Gypsum .... short tons..	90,000	390,000
30	Grindstones	....	570,000
31	Fibrous talc .... short tons..	10,000	110,000
32	Pyrite .... long tons..	35,000	175,000
33	Soapstone .... short tons..	10,000	200,000
34	Manganese ores .... long tons..	10,180	122,160
35	Asphalt .... short tons..	3,000	10,500
36	Precious stones	....	222,975
37	Bromine .... pounds..	281,100	67,464
38	Corundum .... short tons..	600	108,000
39	Barytes (crude) .... do....	25,000	100,000
40	Graphite .... pounds..	....	....
41	Millstones	....	150,000
42	Oilstones, etc.[a] .... pounds..	800,000	12,000
43	Marls .... short tons..	875,000	437,500
44	Flint .... long tons..	30,000	120,000
45	Fluorspar .... short tons..	4,000	20,000
46	Chromic iron ore .... long tons..	2,000	35,000
47	Infusorial earth .... short tons..	1,000	5,000
48	Feldspar .... long tons..	10,900	55,112
49	Mica .... pounds..	147,410	368.525
50	Colbalt oxide .... do....	2,000	5,100
51	Slate ground as a pigment .... short tons..	2,000	20,000
52	Sulphur .... do....	500	12,000
53	Asbestos .... do....	1,000	30,000
54	Rutile .... pounds..	600	2,000
55	Lithographic stone .... short tons..	....	....
56	Total value of nonmetallic mineral products	....	221,879,506
57	Total value of metallic products	....	179,230,899
58	Estimated value of mineral products unspecified	....	5,000,000
59	Grand total	....	406,110,405

[a] Prior to 1889 quantity and value are for rough stone quarried; since 1890 they are for finished product.

the calendar years 1880–1909—Continued.

1885.		1886.		1887.		
Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
4,044,425	$64,712,400	5,683,329	$95,195,760	6,417,148	$121,925,800	1
39,909,400	42,503,500	39,694,000	39,482,400	41,721,600	40,887,200	2
1,538,373	31,801,000	1,686,788	34,869,000	1,603,049	33,136,000	3
170,962,607	18,292,999	161,235,381	16,527,651	185,227,331	21,115,916	4
129,412	10,469,431	130,629	12,200,749	145,700	13,113,000	5
40,688	3,539,856	42,641	3,752,408	50,340	4,782,300	6
32,073	979,189	29,981	1,060,000	33,825	1,429,000	7
277,904	179,975	214,992	127,157	205,566	133,200	8
283	2,550	3,000	27,000	18,000	59,000	9
50	10,000	35	7,000	75	15,000	10
250	187	50	100	448	1,838	11
....	172,491,087	....	203,249,225	....	236,598,254	12
64,840,668	82,347,648	73,707,957	78,481,056	87,887,360	98,004,656	13
34,228,548	76,671,948	34,853,077	76,119,120	37,578,747	84,552,181	14
....	19,000,000	....	19,000,000	....	25,000,000	15
21,847,205	19,198,243	28,064,841	19,996,313	28,278,866	18,877,094	16
40,000,000	20,000,000	....	....	....	....	17
....	4,857,200	....	10,012,000	....	15,817,500	18
....	....	....	6,200,000	....	7,000,000	19
40,320	275,000	44,800	325,000	48,160	340,000	20
4,150,000	3,492,500	4,500,000	3,990,000	6,692,744	5,674,377	21
7,038,653	4,825,345	7,707,081	4,736,585	7,831,962	4,093,846	22
437,856	2,846,064	430,549	1,872,936	480,558	1,836,818	23
3,356,956	1,678,478	4,717,163	2,830,297	5,377,000	3,226,200	24
9,148,401	1,312,845	8,950,317	1,284,070	8,259,609	1,261,463	25
15,000	1,050,000	18,000	1,440,000	18,000	1,440,000	26
3,950	43,575	18,800	315,000	22,000	330,000	27
8,000,000	480,000	9,778,290	488,915	11,000,000	550,000	28
90,405	405,000	95,250	428,625	95,000	425,000	29
....	500,000	....	250,000	....	224,400	30
10,000	110,000	12,000	125,000	15,000	160,000	31
49,000	220,500	55,000	220,000	52,000	210,000	32
10,000	200,000	12,000	225,000	12,000	225,000	33
23,258	190,281	30,193	277,636	34,524	333,844	34
3,000	10,500	3,500	14,000	4,000	16,000	35
....	209,900	....	119,056	....	163,600	36
310,000	89,900	428,334	141,350	199,087	61,717	37
600	108,000	645	116,190	600	108,000	38
15,000	75,000	10,000	50,000	15,000	75,000	39
327,883	26,231	415,525	33,242	416,000	34,000	40
....	100,000	....	140,000	....	100,000	41
1,000,000	15,000	1,160,000	15,000	1,200,000	16,000	42
875,000	437,500	800,000	400,000	600,000	300,000	43
30,000	120,000	30,000	120,000	32,000	128,000	44
5,000	22,500	5,000	22,000	5,000	20,000	45
2,700	40,000	2,000	30,000	3,000	40,000	46
1,000	5,000	1,200	6,000	3.000	15,000	47
13,600	68,000	14,900	74,500	10,200	61,200	48
92,000	161,000	40,000	70,000	70,000	142,250	49
68,723	65,373	35,000	36,878	18,340	18,774	50
1,975	24,687	....	....	....	....	51
715	17,875	2,500	75,000	3,000	100,000	52
300	9,000	200	6,000	150	4,500	53
600	2,000	600	2,000	1,000	3,000	54
....	....	....	....	....	....	55
....	241,312,093	....	230,088,769	....	270,989,420	56
....	172,491,087	....	203,249,225	....	236,598,254	57
....	5,000,000	....	800,000	....	800,000	58
....	418,803,180	....	434,137,994	....	508,387 674	59

Mineral products of the United States for

	Product.	1888.	
		Quantity.	Value.
	METALLIC.		
1	Pig iron, value at Philadelphia........long tons..	6,489,738	$107,000,000
2	Silver, commercial value........troy ounces..	45,792,700	43,045,100
3	Gold, coining value........do....	1,604,478	33,167,500
4	Copper, value at New York City........pounds..	231,270,622	33,833,954
5	Lead, value at New York City........short tons..	151,919	13,399,256
6	Zinc, value at New York City........do....	55,903	5,500,855
7	Quicksilver, value at San Francisco........flasks..	33,250	1,413,125
8	Aluminum, value at Pittsburg........pounds..	19,000	65,000
9	Antimony, value at San Francisco........short tons..	100	20,000
10	Nickel, value at Philadelphia........pounds..	204,328	127,632
11	Tin........do....	....	....
12	Platinum (crude), value at San Francisco........troy ounces..	500	2,000
13	Total value of metallic products........	....	237,574,422
	NONMETALLIC (SPOT VALUES).		
14	Bituminous coal........short tons..	102,039,838	101,860,529
15	Pennsylvania anthracite........long tons..	41,624,611	89,020,483
16	Stone........	....	25,500,000
17	Petroleum........barrels..	27,612,025	17,947,620
18	Natural gas........	....	22,629,875
19	Brick clay........	....	7,500,000
20	Clay (all other than brick)........short tons..	41,160	300,000
21	Cement........barrels..	6,503,295	5,021,139
22	Mineral waters........gallons sold..	9,578,648	1,679,302
23	Phosphate rock........long tons..	448,567	2,018,552
24	Salt........barrels..	8,055,881	4,374,203
25	Limestone for iron flux........long tons..	5,438,000	2,719,000
26	Zinc white........short tons..	20,000	1,600,000
27	Gypsum........do....	110,000	550,000
28	Borax........pounds..	7,589,000	455,340
29	Mineral paints........short tons..	26,500	405,000
30	Grindstones........	....	281,800
31	Fibrous talc........short tons..	20,000	210,000
32	Asphalt........do....	53,800	331,500
33	Soapstone........do....	15,000	250,000
34	Precious stones........	....	139,850
35	Pyrite........long tons..	54,331	167,658
36	Corundum........short tons..	589	91,620
37	Oilstones, etc.[a]........pounds..	1,500,000	18,000
38	Mica........do....	48,000	70,000
39	Barytes (crude)........short tons..	20,000	110,000
40	Bromine........pounds..	307,386	95,290
41	Fluorspar........short tons..	6,000	30,000
42	Feldspar........long tons..	8,700	50,000
43	Manganese ores........do....	29,198	279,571
44	Flint........do....	30,000	127,500
45	Graphite........pounds..	400,000	33,000
46	Bauxite........long tons..	....	....
47	Sulphur........short tons..	....	....
48	Marls........do....	300,000	150,000
49	Infusorial earth........do....	1,500	7,500
50	Millstones........	....	81,000
51	Chromic iron ore........long tons..	1,500	20,000
52	Cobalt oxide........pounds..	8,491	15,782
53	Magnesite........short tons..	....	....
54	Asbestos........do....	100	3,000
55	Rutile........pounds..	1,000	3,000
56	Ozokerite (refined)........do....	43,500	3,000
57	Total value of nonmetallic mineral products........	....	286,150,114
58	Total value of metallic products........	....	237,574,422
59	Estimated value of mineral products unspecified........	....	900,000
60	Grand total........	....	524,624,536

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[a] Prior to 1889 quantity and value are for rough stone quarried; since 1890 they are for finished product.

the calendar years 1880–1909—Continued.

1889.		1890.		1891.		
Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
7,603,642	$120,000,000	9,202,703	$151,200,410	8,279,870	$128,387,985	1
50,094,500	46,838,400	54,516,300	57,242,100	58,330,000	57,630,000	2
1,594,775	32,967,000	1,588,877	32,845,000	1,604,840	33,175,000	3
231,246,214	26,907,809	265,115,133	30,848,797	295,812,076	38,455,300	4
156,397	13,794,235	143,630	12,668,166	178,554	15,534,198	5
58,860	5,791,824	63,683	6,266,407	80,873	8,033,700	6
26,484	1,190,500	22,926	1,203,615	22,904	1,036,386	7
47,468	97,335	61,281	61,281	150,000	100,000	8
115	28,000	938	177,508	1,289	217,957	9
252,663	151,598	223,488	134,093	118,498	71,099	10
....	....	....	....	125,289	25,058	11
500	2,000	600	2,500	100	500	12
....	247,768,701	....	292,649,877	....	282,617,183	13
95,685,543	94,504,745	111,320,016	110,420,801	117,901,237	117,188,400	14
40,714,721	65,879,514	41,489,858	66,383,772	45,236,992	73,944,735	15
....	42,809,706	....	47,000,000	....	47,294,746	16
35,163,513	26,963,340	45,822,672	35,365,105	54,291,980	30,526,553	17
....	21,097,099	....	18,792,725	....	15,500,084	18
....	8,000,000	....	8,500,000	....	9,000,000	19
329,665	635,578	392,000	756,000	448,000	900,000	20
7,000,000	5,000,000	8,000,000	6,000,000	8,222,792	6,680,951	21
12,780,471	1,748,458	13,907,418	2,600,750	18,392,732	2,996,259	22
550,245	2,937,776	510,499	3,213,795	587,988	3,651,150	23
8,005,565	4,195,412	8,776,991	4,752,286	9,987,945	4,716,121	24
6,318,000	3,159,000	5,521,622	2,760,811	5,000,000	2,300,000	25
16,970	1,357,600	....	1,600,000	23,700	1,600,000	26
267,769	764,118	182,995	574,523	208,126	628,051	27
8,000,000	500.000	9,500,000	617,500	13,380,000	869,700	28
34,307	483,766	47,732	681,992	49,652	678,478	29
....	439,587	....	450,000	....	476,113	30
23,746	244,170	41,354	389,196	53,054	493,068	31
51,735	171,537	40,841	190,416	45,054	242,264	32
12,715	231,708	13,670	252,309	16,514	243,981	33
....	188,807	....	118,833	....	235,300	34
93,705	202,119	99,854	273,745	106,536	338,880	35
2,245	105,565	1,970	89,395	2,265	90,230	36
5,982,000	32,980	....	69,909	1,375,000	150,000	37
49,500	50,000	60,000	75,000	75,000	100,000	38
19,161	106,313	21,911	86,505	31,069	118,363	39
418,891	125,667	387,847	104,719	343,000	54,880	40
9,500	45,835	8,250	55,328	10,044	78,330	41
6,970	39,370	8,000	45,200	10,000	50,000	42
24,197	240,559	25,684	219,050	23,416	239,129	43
21,113	89,730	13,000	57,400	15,000	60,000	44
....	72,662	....	77,500	....	110,000	45
728	2,366	1,844	6,012	3,593	11,675	46
1,150	7,850	....	....	1,200	39,600	47
139,522	63,956	153,620	69 880	135,000	67,500	48
3,466	23,372	2,532	50,240	....	21,988	49
....	35,155	....	23.720	....	16,587	50
2,000	30,000	3,599	53,985	1,372	20,580	51
13,955	31,092	6,788	16,291	7,200	18,000	52
....	....	....	....	439	4,390	53
30	1,800	71	4,560	66	3,390	54
1,000	3,000	400	1,000	300	800	55
50,000	2,500	350,000	26,250	50,000	7,000	56
....	282,623,812	....	312,826,503	....	321,767,846	57
....	247,768,701	....	292,649,877	....	282,617,183	58
....	1,000,000	....	1,000,000	....	1,000,000	59
....	531,392,513	....	606,476,380	....	605,385,029	60

Mineral products of the United States for

	Product.		1892.	
			Quantity.	Value.
	METALLIC.			
1	Pig iron, spot value	long tons	9,157,000	$131,161,039
2	Silver, commercial value	troy ounces	63,500,000	55,662,500
3	Gold, coining value	do	1,597,098	33,015,000
4	Copper, value at New York City	pounds	352,971,744	37,977,142
5	Lead, value at New York City	short tons	173,654	13,892,320
6	Zinc, value at New York City	do	87,260	8,027,920
7	Quicksilver, value at San Francisco	flasks	27,993	1,245,689
8	Aluminum, value at Pittsburg	pounds	259,885	172,824
9	Antimony, value at San Francisco	short tons	1,790	276,416
10	Nickel, value at Philadelphia	pounds	92,252	50,739
11	Tin	do	162,000	32,400
12	Platinum, value (crude) at San Francisco	troy ounces	80	550
13	Total value of metallic products		....	281,514,539
	NONMETALLIC (SPOT VALUES).			
14	Bituminous coal	short tons	126,856,567	125,124,381
15	Pennsylvania anthracite	long tons	46,850,450	82,442,000
16	Natural gas		....	14,870,714
17	Petroleum	barrels	50,509,136	26,034,196
18	Brick clay		....	9,000,000
19	Cement	barrels	8,758,621	7,152,750
20	Stone		....	48,706,625
21	Corundum and emery	short tons	1,771	181,300
22	Crystalline quartz	do	....	....
23	Garnet for abrasive purposes	do	....	....
24	Grindstones		....	272,244
25	Infusorial earth and tripoli	short tons	....	43,655
26	Millstones		....	23,417
27	Oilstones, etc		....	146,730
28	Borax	pounds	13,500,000	900,000
29	Bromine	do	379,480	64,502
30	Fluorspar	short tons	12,250	89,000
31	Gypsum	do	256,259	695,492
32	Marls	do	125,000	65,000
33	Phosphate rock	long tons	681,571	3,296,227
34	Pyrite	do	109,788	305,191
35	Salt	barrels	11,698,890	5,654,915
36	Sulphur	short tons	2,688	80,640
37	Barytes (crude)	do	32,108	130,025
38	Cobalt oxide	pounds	7,869	15,738
39	Mineral paints	short tons	51,704	767,766
40	Zinc white	do	27,500	2,200,000
41	Asbestos	do	104	6,416
42	Asphalt	do	87,680	445,375
43	Bauxite	long tons	10,518	34,183
44	Chromic iron ore	do	1,500	25,000
45	Clay (all other than brick)	short tons	470,400	1,000,000
46	Feldspar	do	16,800	75,000
47	Fibrous talc	do	41,925	472,485
48	Flint	do	22,400	80,000
49	Fuller's earth	do	....	....
50	Graphite	pounds	....	104,000
51	Limestone for iron flux	long tons	5,172,114	3,620,480
52	Magnesite	short tons	1,004	10,040
53	Manganese ores	long tons	13,613	129,586
54	Mica	pounds	75,000	100,000
55	Mineral waters	gallons sold	21,876,604	4,905,970
56	Monazite	pounds	....	....
57	Ozokerite (refined)	do	60,000	8,000
58	Precious stones		....	312,050
59	Pumice stone	short tons	....	....
60	Rutile	pounds	100	300
61	Soapstone	short tons	23,908	437,449
62	Total value of nonmetallic mineral products		....	340,028,842
63	Total value of metallic products		....	281,514,539
64	Estimated value of mineral products unspecified		....	1,000,000
65	Grand total		....	622,543,381

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a Including copper made from imported pyrites.

the calendar years 1880–1909—Continued.

1893.		1894.		1895.		
Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
7,124,502	$84,810,426	6,657,388	$65,007,247	9,446,308	$105,198,550	1
60,000,000	46,800,000	49,500,000	31,422,100	55,727,000	36,445,500	2
1,739,323	35,955,000	1,910,813	39,500,000	2,254,760	46,610,000	3
339,785,972	32,054,601	364,866,808	33,141,142	a 385,913,404	38,012,470	4
163,982	11,839,590	159,331	9,942,254	170,000	11,220,000	5
78,832	6,306,560	75,328	5,288,026	89,686	6,278,020	6
30,164	1,108,527	30,416	934,000	36,104	1,337,131	7
339,629	266,903	550,000	316,250	920,000	464,600	8
1,503	270,540	1,387	249,706	2,013	304,169	9
49,399	22,197	9,616	3,269	10,302	3,091	10
8,938	1,788					11
75	517	100	600	150	900	12
	219,436,649		185,804,594		245,874,431	13
128,385,231	122,751,618	118,820,405	107,653,501	135,118,193	115,779,771	14
48,185,306	85,687,078	46,358,144	78,488,063	51,785,122	82,019,272	15
	14,346,250		13,954,400		13,006,650	16
48,412,666	28,932,326	49,344,516	35,522,095	52,892,276	57,632,296	17
	9,000,000		b 64,655,388		b 65,409,806	18
8,002,467	6,262,841	8,362,245	5,030,081	8,731,401	5,482,254	19
	33,885,573		36,534,788		33,319,131	20
1,713	142,325	1,495	95,936	2,102	106,256	21
		6,024	18,054	9,000	27,000	22
				3,325	95,050	23
	338,787		223,214		205,768	24
	22,582	2,584	11,718	4,954	20,514	25
	16,645		13,887		22,542	26
	135,173		136,873		155,881	27
8,699,000	652,425	14,680,130	974,445	11,918,000	595,900	28
348,399	104,520	379,444	102,450	517,421	134,343	29
12,400	84,000	7,500	47,500	4,000	24,000	30
253,615	696,615	239,312	761,719	265,503	797,447	31
75,000	40,000	75,000	40,000	60,000	30,000	32
941,368	4,136,070	996,949	3,479,547	1,038,551	3,606,094	33
75,777	256,552	105,940	363,134	99,549	322,845	34
11,816,772	4,054,668	12,967,417	4,739,285	13,669,649	4,423,084	35
1,200	42,000	500	20,000	1,800	42,000	36
28,970	88,506	23,335	86,983	21,529	68,321	37
8,422	10,346	6,763	10,145	14,458	20,675	38
37,724	530,384	41,926	498,093	50,695	621,552	39
24,059	1,804,420	19,987	1,399,090	20,710	1,449,700	40
50	2,500	325	4,463	795	13,525	41
47,779	372,232	60,570	353,400	68,163	348,281	42
9,079	29,507	11,066	35,818	17,069	44,000	43
1,450	21,750	3,680	53,231	1,740	16,795	44
448,000	900,000					45
20,578	68,307	19,264	167,000	8,523	30,000	46
35,861	403,436	39,906	435,060	39,240	370,897	47
33,231	63,792	42,560	319,200	13,747	21,038	48
				6,900	41,400	49
843,103	63,232	918,000	64,010		52,582	50
3,958,055	2,374,833	3,698,550	1,849,275	5,247,949	2,623,974	51
704	7,040	1,440	10,240	2,220	17,000	52
7,718	66,614	6,308	53,635	9,547	71,769	53
66,971	88,929		52,388		55,831	54
23,544,495	4,246,734	21,569,608	3,741,846	21,463,543	4,254,237	55
130,000	7,600	546,855	36,193	1,573,000	137,150	56
						57
	264,041		132,250		113,621	58
						59
		150	450	100	350	60
21,071	255,067	23,144	401,325	21,495	266,495	61
	323,257,318		362,570,173		393,897,097	62
	219,436,649		185,804,594		245,874,431	63
	1,000,000		1,000,000		1,000,000	64
	543,693,967		549,374,767		640,771,528	65

b Clay products.

Mineral products of the United States for

	Product.	1896.	
		Quantity.	Value.
	METALLIC.		
1	Pig iron, spot value.....long tons..	8,623,127	$90,250,000
2	Silver, commercial value.....troy ounces..	58,834,800	39,654,600
3	Gold, coining value.....do...	2,568,132	53,088,000
4	Copper, value at New York City.....pounds..	460,061,430	49,456,603
5	Lead, value at New York City.....short tons..	188,000	10,528,000
6	Zinc, value at New York City.....do...	81,499	6,519,920
7	Quicksilver, value at San Francisco.....flasks..	30,765	1,075,449
8	Aluminum, value at Pittsburg.....pounds..	1,300,000	520,000
9	Antimony, value at San Francisco.....short tons..	2,478	347,539
10	Nickel, value at Philadelphia.....pounds..	17,170	4,464
11	Tin.....do...	.....	.....
12	Platinum, value (crude) at New York City.....troy ounces..	163	944
13	Total value of metallic products.....	.....	251,445,519
	NONMETALLIC (SPOT VALUES).		
14	Bituminous coal.....short tons..	137,640,276	114,891,515
15	Pennsylvania anthracite.....long tons..	48,523,287	81,748,651
16	Natural gas.....	.....	13,002,512
17	Petroleum.....barrels..	60,960,361	58,518,709
18	Clay products.....	.....	63,110,408
19	Cement.....barrels..	9,513,473	6,473,213
20	Lime.....	.....	6,327,900
21	Slate.....	.....	2,746,205
22	Stone.....	.....	23,965,229
23	Corundum and emery.....short tons..	2,120	113,246
24	Crystalline quartz.....do...	6,000	18,000
25	Garnet for abrasive purposes.....do...	2,686	68,877
26	Grindstones.....	.....	326,826
27	Infusorial earth and tripoli.....short tons..	3,846	26,792
28	Millstones.....	.....	22,567
29	Oilstones, etc.....	.....	127,098
30	Borax.....pounds..	13,508,000	675,400
31	Bromine.....do...	546,580	144,501
32	Fluorspar.....short tons..	6,500	52,000
33	Gypsum.....do...	224,254	573,344
34	Marls.....do...	60,000	30,000
35	Phosphate rock.....long tons..	930,779	2,803,372
36	Pyrite.....do...	115,483	320,163
37	Salt.....barrels..	13,850,726	4,040,839
38	Sulphur.....short tons..	5,260	87,200
39	Barytes (crude).....do...	17,068	46,513
40	Cobalt oxide.....pounds..	10,700	15,301
41	Mineral paints.....short tons..	43,894	459,089
42	Zinc white.....do...	20,000	1,400,000
43	Asbestos.....do...	504	6,100
44	Asphalt.....do...	80,503	577,563
45	Bauxite.....long tons..	18,364	47,338
46	Chromic iron ore.....do...	786	6,667
47	Feldspar.....short tons..	10,203	35,200
48	Fibrous talc.....do...	46,089	399,443
49	Fuller's earth.....do...	9,872	59,360
50	Graphite (crystalline).....pounds..	535,858	48,460
51	Graphite (amorphous).....short tons..	760	
52	Magnesite.....do...	1,500	11,000
53	Manganese ores.....long tons..	10,088	90,727
54	Mica (sheet).....pounds..	49,156	65,441
55	Mica (scrap).....short tons..	222	1,750
56	Mineral waters.....gallons sold..	25,795,312	4,136,192
57	Monazite.....pounds..	30,000	1,500
58	Ozokerite (refined).....do...	.....	.....
59	Precious stones.....	.....	97,850
60	Pumice stone.....short tons..	.....	.....
61	Quartz (flint).....do...	12,458	24,226
62	Rutile.....pounds..	100	350
63	Soapstone.....short tons..	22,183	354,065
64	Total value of nonmetallic mineral products.....	.....	388,098,702
65	Total value of metallic products.....	.....	251,445,519
66	Estimated value of mineral products unspecified.....	.....	1,000,000
67	Grand total.....	.....	640,544,221

the calendar years 1880–1909—Continued.

1897.		1898.		1899.		
Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
9,652,680	$95,122,299	11,773,934	$116,557,000	13,620,703	$245,172,654	1
53,860,000	32,316,000	54,438,000	32,118,400	54,764,500	32,858,700	2
2,774,935	57,363,000	3,118,398	64,463,000	3,437,210	71,053,400	3
494,078,274	54,080,180	526,512,987	61,865,276	568,666,921	101,222,712	4
212,000	14,885,728	222,000	16,650,000	210,500	18,945,000	5
99,980	8,498,300	115,399	10,385,910	129,051	14,840,865	6
26,648	993,445	31,092	1,188,627	30,454	1,452,745	7
4,000,000	1,500,000	5,200,000	1,716,000	6,500,000	1,716,000	8
3,061	442,300	3,238	532,101	2,861	559,189	9
23,707	7,823	11,145	3,956	22,541	8,566	10
.....	.....	.....	.....	.....	.....	11
150	900	225	1,913	300	1,800	12
.....	265,209,975	.....	305,482,183	.....	487,831,631	13
147,617,519	119,595,224	166,593,623	132,608,713	193,323,187	167,952,104	14
46,974,714	79,301,954	47,663,076	75,414,537	53,944,647	88,142,130	15
.....	13,826,422	.....	15,296,813	.....	20,074,873	16
60,475,516	40,874,072	55,364,233	44,193,359	57,070,850	64,603,904	17
.....	62,359,991	.....	74,487,680	.....	95,797,370	18
10,989,463	8,178,283	12,111,208	9,859,501	15,520,445	12,889,142	19
.....	6,390,487	.....	6,886,549	.....	6,983,067	20
.....	3,524,614	.....	3,723,540	.....	3,962,733	21
.....	26,876,671	.....	28,635,175	.....	35,244,717	22
2,165	106,574	4,064	275,064	4,900	150,600	23
7,500	22,500	8,312	23,990	13,600	39,000	24
2,554	80,853	2,967	86,850	2,765	98,325	25
.....	368,058	.....	489,769	.....	675,586	26
3,833	22,835	2,733	16,691	4,334	37,032	27
.....	25,932	.....	25,934	.....	28,115	28
.....	149,970	.....	180,486	.....	208,283	29
16,000,000	1,080,000	16,000,000	1,120,000	40,714,000	1,139,882	30
487,149	129,094	486,979	126,614	433,004	108,251	31
5,062	37,159	7,675	63,050	15,900	96,650	32
288,982	755,864	291,638	755,280	486,235	1,287,080	33
60,000	30,000	60,000	30,000	60,000	30,000	34
1,039,345	2,673,202	1,308,885	3,453,460	1,515,702	5,084,076	35
143,201	391,541	193,364	593,801	174,734	543,249	36
15,973,202	4,920,020	17,612,634	6,212,554	19,708,614	6,867,467	37
2,275	45,590	1,200	32,960	4,830	107,500	38
26,042	58,295	31,306	108,339	41,894	139,528	39
19,520	31,232	6,247	9,371	10,230	18,512	40
47,308	501,029	48,479	534,345	51,020	517,328	41
25,000	1,750,000	33,000	2,310,000	40,146	3,211,680	42
580	6,450	605	10,300	681	11,740	43
75,945	664,632	76,337	675,649	75,085	553,904	44
20,590	57,652	25,149	75,437	35,280	125,598	45
.....	.....	.....	.....	.....	.....	46
12,516	43,100	13,440	32,395	24,202	211,545	47
57,009	396,936	54,356	411,430	54,655	438,150	48
17,113	112,272	14,860	106,500	12,381	79,644	49
1,361,706	65,730	2,360,000	75,200	2,900,732	167,106	50
1,070		890		2,324		51
1,143	13,671	1,263	19,075	1,280	18,480	52
11,108	95,505	15,957	129,185	9,935	82,278	53
82,676	80,774	129,520	103,534	108,570	70,587	54
740	14,452	3,999	27,564	1,505	50,878	55
23,255,911	4,599,106	28,853,464	8,051,833	39,562,136	6,948,030	56
44,000	1,980	250,776	13,542	350,000	20,000	57
.....	.....	.....	.....	.....	.....	58
.....	130,675	.....	160,920	.....	185,770	59
158	.....	600	13,200	400	10,000	60
13,466	26,227	21,425	42,670	29,852	180,345	61
100	350	140	700	230	1,030	62
21,923	365,629	22,231	287,112	24,765	330,805	63
.....	380,782,607	.....	417,790,671	.....	525,524,074	64
.....	265,209,975	.....	305,482,183	.....	487,831,631	65
.....	1,000,000	.....	1,000,000	.....	1,000,000	66
.....	646,992,582	.....	724,272,854	.....	1,014,355,705	67

Mineral products of the United States for

	Product.	1900.	
		Quantity.	Value.
	METALLIC.		
1	Pig iron, value at Philadelphia...long tons..	13,789,242	$259,944,000
2	Silver, commercial value...troy ounces..	57,647,000	35,741,100
3	Gold, coining value...do...	3,829,897	79,171,000
4	Copper, value at New York City...pounds..	606,117,166	98,494,039
5	Lead, value at New York City...short tons..	270,824	23,561,688
6	Zinc, value at New York City...do...	123,886	10,654,196
7	Quicksilver, value at San Francisco...flasks..	28,317	1,302,586
8	Aluminum, value at Pittsburg...pounds..	7,150,000	1,920,000
9	Antimony, value at San Francisco...short tons..	4,226	837,896
10	Nickel, value at Philadelphia...pounds..	9,715	3,886
11	Tin...do...		
12	Platinum, value (crude) at New York City...troy ounces..	400	2,500
13	Total value of metallic products...		511,632,891
	NONMETALLIC (SPOT VALUES).		
14	Bituminous coal...short tons..	212,316,112	220,930,313
15	Pennsylvania anthracite...long tons..	51,221,353	85,757,851
16	Natural gas...		23,698,674
17	Petroleum...barrels..	63,620,529	75,989,313
18	Clay products...		96,212,345
19	Cement...barrels..	17,231,150	13,283,581
20	Lime...		6,797,496
21	Sand-lime brick...		
22	Slate...		4,240,466
23	Stone...		36,970,777
24	Corundum and emery...short tons..	4,305	102,715
25	Crystalline quartz...do...	14,461	40,705
26	Garnet for abrasive purposes...do...	3,185	123,475
27	Grindstones...		710,026
28	Infusorial earth and tripoli...short tons..	3,615	24,207
29	Millstones...		32,858
30	Oilstones, etc...		174,087
31	Arsenious oxide...pounds..		
32	Borax...short tons..	[b]1,602 [c]24,235	170,036 848,215
33	Bromine...pounds..	521,444	140,790
34	Fluorspar...short tons..	18,450	94,500
35	Gypsum...do...	594,462	1,627,203
36	Lithium...do...	520	
37	Marls...do...	60,000	30,000
38	Phosphate rock...long tons..	1,491,216	5,359,248
39	Pyrite...do...	204,615	749,991
40	Sulphur...short tons..	3,525	88,100
41	Salt...barrels..	20,869,342	6,944,603
42	Barytes (crude)...short tons..	67,680	188,089
43	Cobalt oxide...pounds..	6,471	11,648
44	Mineral paints...short tons..	57,426	644,089
45	Zinc white...do...	48,840	3,667,210
46	Asbestos...do...	1,054	16,310
47	Asphalt...do...	54,389	415,958
48	Bauxite...long tons..	23,184	89,676
49	Chromic iron ore...do...	140	1,400
50	Feldspar...short tons..	24,821	180,971
51	Fibrous talc...do...	63,500	499,500
52	Fuller's earth...do...	9,698	67,535
53	Glass sand...do...		
54	Graphite (crystalline)...pounds..	5,507,855	197,579
55	Graphite (amorphous)...short tons..	611	
56	Magnesite...do...	2,252	19,333
57	Manganese ores...long tons..	11,771	100,289
58	Mica (sheet)...pounds..	456,283	92,758
59	Mica (scrap)...short tons..	5,497	55,202
60	Mineral waters...gallons sold..	47,558,784	6,245,172
61	Monazite and zircon...pounds..	908,000	48,805
62	Precious stones...		233,170
63	Pumice stone...short tons..		
64	Quartz (flint)...do...	32,495	86,351
65	Rutile...pounds..	300	1,300
66	Talc and soapstone...short tons..	27,943	383,541
67	Tungsten...do...	46	11,040
68	Uranium and vanadium...do...		
69	Total value of nonmetallic mineral products...		594,398,501
70	Total value of metallic products...		511,632,891
71	Estimated value of mineral products unspecified...		1,000,000
72	Grand total...		1,107,031,392

[a] No metallic tin; about 20 tons of high-grade concentrates shipped to England from South Carolina.

the calendar years 1880–1909—Continued.

1901.		1902.		1903.		
Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
15,878,354	$242,174,000	17,821,307	$372,775,000	18,009,252	$344,350,000	1
55,214,000	33,128,400	55,500,000	29,415,000	54,300,000	29,322,000	2
3,805,500	78,666,700	3,870,000	80,000,000	3,560,000	73,591,700	3
602,072,519	87,300,515	659,508,644	76,568,954	698,044,517	91,506,006	4
270,700	23,280,200	270,000	22,140,000	282,000	23,520,000	5
140,822	11,265,760	156,927	14,625,592	159,219	16,717,995	6
29,727	1,382,305	34,291	1,467,848	35,620	1,544,934	7
7,150,000	2,238,000	7,300,000	2,284,590	7,500,000	2,284,900	8
2,639	539,902	3,561	634,506	3,128	548,433	9
6,700	3,551	5,748	2,701	114,200	45,900	10
....	....	....	....	(a)	....	11
1,408	27,526	94	1,814	110	2,080	12
....	480,006,859	....	599,916,009	....	583,433,948	13
225,828,149	236,422,049	260,216,844	290,858,483	282,749,348	351,687,933	14
60,242,560	112,504,020	36,940,710	76,173,586	66,613,454	152,036,448	15
....	27,066,077	....	30,867,863	....	35,807,860	16
69,389,194	66,417,335	88,766,916	71,178,910	100,461,337	94,694,050	17
....	110,211,587	....	122,169,531	....	131,062,421	18
20,068,737	15,786,789	25,753,504	25,366,380	29,899,140	31,931,341	19
....	8,204,054	....	9,335,618	....	9,255,882	20
....	....	....	....	....	155,040	21
....	4,787,525	....	5,696,051	....	6,256,885	22
....	47,284,183	....	54,798,682	....	57,433,141	23
4,305	146,040	4,251	104,605	2,542	64,102	24
14,050	41,500	15,104	84,335	8,938	76,908	25
4,444	158,100	3,926	132,820	3,950	132,500	26
....	580,703	....	667,431	....	721,446	27
4,020	52,950	5,665	53,244	9,219	76,273	28
....	57,179	....	59,808	....	52,552	29
....	158,300	....	221,762	....	366,857	30
600,000	18,000	2,706,000	81,180	1,222,000	36,691	31
b 5,344 c 17,887	697,307 314,811	b 17,404 c 2,600	2,447,614 91,000	c 34,430	661,400	32
552,043	154,572	513,893	128,472	598,500	167,580	33
19,586	113,803	48,018	271,832	42,523	213,617	34
633,791	1,506,641	816,478	2,089,341	1,041,704	3,792,943	35
1,750	43,200	1,245	25,750	1,155	23,425	36
99,880	124,880	12,439	12,741	34,211	22,521	37
1,483,723	5,316,403	1,490,314	4,693,444	1,581,576	5,319,294	38
241,691	1,257,879	207,874	947,089	d 233,127	1,109,818	39
(d)	(d)	(d)	(d)			40
20,566,661	6,617,449	23,849,231	5,668,636	18,968,089	5,286,988	41
49,070	157,844	61,668	203,154	50,397	152,150	42
13,360	24,048	3,730	6,714	120,000	228,000	43
52,209	636,145	60,191	745,227	56,262	500,922	44
46,500	3,720,000	52,645	4,016,499	62,962	4,801,718	45
747	13,498	1,005	16,200	887	16,760	46
63,134	555,335	105,458	765,048	101,255	1,005,446	47
18,905	79,914	27,322	120,366	48,087	171,306	48
368	5,790	315	4,567	150	2,250	49
34,741	220,422	45,287	250,424	41,891	256,733	50
69,200	483,600	71,100	615,350	60,230	421,600	51
14,112	96,835	11,492	98,144	20,693	190,277	52
....	....	943,135	807,797	823,044	855,828	53
3,967,612	167,714	3,936,824	182,108	4,538,155	225,554	54
809		4,739		16,591		55
3,500	10,500	2,830	8,490	3,744	10,595	56
11,995	116,722	7,477	60,911	2,825	25,335	57
360,960	98,859	373,266	83,843	619,600	118,088	58
2,171	19,719	1,400	35,006	1,659	25,040	59
55,771,188	7,586,962	64,859,451	8,793,761	51,242,757	9,041,078	60
748,736	59,262	802,000	64,160	865,000	65,200	61
....	289,050	....	328,450	....	307,900	62
....	....	700	2,750	885	2,665	63
34,420	149,297	36,365	144,209	55,233	156,947	64
44,250	5,710	(e)	....	....	....	65
28,643	424,888	26,854	525,157	26,671	418,460	66
179	27,720	184	34,040	292	43,639	67
375	....	3,810	48,125	30	5,625	68
....	660,993,170	....	722,186,708	....	907,495,032	69
....	480,006,859	....	599,916,009	....	583,433,948	70
....	1,000,000	....	1,000,000	....	1,000,000	71
....	1,142,000,029	....	1,323,102,717	....	1,491,928,980	72

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b Refined. c Crude. d Included under pyrite. e Included under estimated unspecified products.

Mineral products of the United States for the calendar years 1880–1909—Continued.

Product.	1904.		1905.	
	Quantity.	Value.	Quantity.	Value.
METALLIC.				
Pig iron (spot value)..........long tons..	16,497,033	$233,025,000	22,992,380	$382,450,000
Silver, commercial value..........troy ounces..	57,682,800	33,456,000	56,101,600	34,221,976
Gold, coining value..........do....	3,892,480	80,464,700	4,265,742	88,180,700
Copper, value at New York City..........pounds..	812,537,267	105,629,845	901,907,843	139,795,716
Lead, value at New York City..........short tons..	307,000	26,402,000	302,000	28,690,000
Zinc, value at New York City..........do....	186,702	18,670,200	203,849	24,054,182
Quicksilver, value at San Francisco..........flasks..	34,570	1,503,795	30,451	1,103,120
Aluminum, value at Pittsburg..........pounds..	8,600,000	2,477,000	11,347,000	3,246,300
Antimony, value, San Francisco...short tons..	3,057	505,524	3,240	705,787
Nickel, value at Philadelphia..........pounds..	24,000	11,400	....	....
Tin..........do...	....	....	None.	....
Platinum, value at New York City, troy ounces..........	200	4,160	318	5,320
Total value of metallic products..........	....	502,149,624	....	702,453,101
NONMETALLIC (SPOT VALUES).				
Bituminous coal..........short tons..	278,659,689	305,397,001	315,062,785	334,658,294
Pennsylvania anthracite..........long tons..	65,318,490	138,974,020	69,339,152	141,879,000
Natural gas..........	....	38,496,760	....	41,562,855
Petroleum..........barrels..	117,080,960	101,175,455	134,717,580	84,157,399
Clay products..........	....	131,023,248	....	149,697,188
Cement..........barrels..	31,675,257	26,031,920	40,102,308	35,931,533
Lime..........short tons..	2,707,809	9,951,456	2,984,100	10,941,680
Sand-lime brick..........	....	463,128	....	972,064
Slate..........	....	5,617,195	....	5,496,207
Stone..........	....	58,765,715	....	63,798,748
Corundum and emery..........short tons..	1,916	56,985	2,126	61,464
Crystalline quartz..........do....	31,940	74,850	19,039	88,118
Garnet for abrasive purposes..........do....	3,854	117,581	5,050	148,095
Grindstones..........	....	881,527	....	777,606
Infusorial earth and tripoli..........short tons..	6,274	44,164	10,977	64,637
Millstones..........	....	37,338	....	37,974
Oilstones, etc..........	....	188,985	....	244,546
Arsenious oxide..........pounds..	72,413	2,185	1,507,386	35,210
Borax (crude)..........short tons..	45,647	698,810	46,334	1,019,154
Bromine..........pounds..	897,100	269,130	1,192,758	178,914
Fluorspar..........short tons..	36,452	234,755	57,385	362,488
Gypsum..........do....	940,917	2,784,325	1,043,202	3,029,227
Lithium minerals..........do....	577	5,155	79	1,412
Marls..........do....	18,989	13,145	38,026	16,494
Phosphate rock..........long tons..	1,874,428	6,580,875	1,947,190	6,763,403
Pyrite..........do....	334,373	3,478,568	253,000	938,492
Sulphur..........do....			181,677	3,706,560
Salt..........barrels..	22,030,002	6,021,222	25,966,122	6,095,922
Barytes (crude)..........short tons..	65,727	174,958	48,235	148,803
Cobalt oxide..........pounds..	22,000	42,600	....	....
Mineral paints..........short tons..	64,592	1,448,551	70,355	1,932,048
Zinc white..........do....	63,363	4,808,482	68,603	5,520,240
Asbestos..........do....	1,480	25,740	3,109	42,975
Asphalt..........do....	108,572	879,836	115,267	758,153
Bauxite..........long tons..	47,661	235,704	48,129	240,292
Chromic iron ore..........do....	123	1,845	22	375
Feldspar..........short tons..	45,188	266,326	35,419	226,157
Fibrous talc..........do....	64,005	507,400	56,500	445,000
Fuller's earth..........do....	29,480	168,500	25,178	214,497
Glass sand..........do....	858,719	796,492	1,060,334	1,107,730
Graphite (crystalline)..........pounds..	5,681,177	321,372	6,036,567	318,211
Graphite (amorphous)..........short tons..	16,927		21,953	
Magnesite..........do....	2,850	9,298	3,933	15,221
Manganese ores..........long tons..	3,146	29,466	4,118	36,214
Mica (sheet)..........pounds..	668,358	109,462	924,875	160,732
Mica (scrap)..........short tons..	1,096	10,854	1,126	17,856
Mineral waters..........gallons sold..	50,723,500	7,198,450	47,590,081	6,811,611
Monazite and zircon..........pounds..	745,999	85,038	1,352,418	163,908
Precious stones..........	....	324,300	....	326,350
Pumice stone..........short tons..	1,530	5,421	1,832	5,540
Quartz (flint)..........do....	52,270	100,590	51,145	104,109
Rutile..........pounds..	....	7,000	....	....
Sand, molding, etc., and gravel...short tons..	9,821,009	4,951,607	22,144,633	10,115,915
Talc and soapstone..........do....	27,184	433,331	40,134	637,062
Tungsten..........do....	740	184,000	803	268,676
Uranium and vanadium..........do....	45	10,600	4	375
Total value of nonmetallic mineral products..........	....	860,522,721	....	2,282,734
Total value of metallic products..........	....	502,149,624	....	702,453,101
Estimated value of mineral products unspecified..........	....	400,000	....	400,000
Grand total..........	....	1,363,072,345	....	1,625,135,835

Mineral products of the United States for the calendar years 1880–1909—Continued.

Product.	1906.		1907.	
	Quantity.	Value.	Quantity.	Value.
METALLIC.				
Pig iron, spot value...long tons	25,307,191	$505,700,000	25,781,361	$529,958,000
Silver, commercial value...troy ounces	56,517,900	38,256,400	56,514,700	37,299,700
Gold, coining value...do	4,565,333	94,373,800	4,374,827	90,435,700
Copper, value at New York City...pounds	917,805,682	177,595,888	868,996,491	173,799,300
Lead, value at New York City...short tons	350,153	39,917,442	365,166	38,707,596
Zinc, value at New York City...do	199,694	24,362,668	223,745	26,401,910
Quicksilver, value at San Francisco...flasks	26,238	958,634	21,567	828,931
Aluminum, value at Pittsburg...pounds	14,910,000	4,262,286	17,211,039	4,926,948
Antimony, value, San Francisco, short tons	1,766	602,949	351	77,300
Antimonial lead...do			9,910	1,322,985
Nickel, value at Philadelphia...pounds		(a)		(a)
Tin...do		35,600		33,285
Platinum, value at New York City, troy ounces	1,439	45,189	357	10,589
Total value of metallic products		886,110,856		903,802,244
NONMETALLIC (SPOT VALUES).				
Bituminous coal...short tons	342,874,867	381,162,115	394,759,112	451,214,842
Pennsylvania anthracite...long tons	63,645,010	131,917,694	76,432,421	163,584,056
Natural gas		46,873,932		54,222,399
Petroleum...barrels	126,493,936	92,444,735	166,095,335	120,106,749
Clay products		161,032,722		158,942,369
Cement...barrels	51,000,445	55,302,277	52,230,342	55,903,851
Lime...short tons	3,198,087	12,480,653	3,092,524	12,656,705
Sand-lime brick		1,170,005		1,225,769
Slate		5,668,346		6,019,220
Stone		66,378,794		71,105,805
Corundum and emery...short tons	1,160	44,310	1,069	12,294
Abrasive quartz and feldspar...do	24,082	121,671	17,435	126,582
Garnet for abrasive purposes...do	4,650	157,000	7,058	211,686
Irindstones		744,894		896,022
Infusorial earth and tripoli...short tons	8,099	72,108		104,406
Millstones		48,590		31,741
Oilstones, etc		268,070		264,188
Arsenious oxide...pounds	1,474,000	63,460	3,502,000	163,000
Borax (crude)...short tons	58,173	1,182,410	52,850	1,121,520
Bromine...pounds	1,283,250	165,204	1,379,496	195,281
Fluorspar...short tons	40,796	244,025	49,486	287,282
Gypsum...do	1,540,585	3,837,975	1,751,748	4,942,264
Lithium minerals...do	383	7,411	530	11,000
Marls...do	19,104	7,341	14,091	8,429
Phosphate rock...long tons	2,080,957	8,579,437	2,265,343	10,653,558
Pyrite...do	261,422	931,305	247,387	794,949
Sulphur...do	294,153	5,096,678	293,106	5,142,850
Salt...barrels	28,172,380	6,658,350	29,704,128	7,608,323
Barytes (crude)...short tons	50,231	160,367	89,621	291,777
Cobalt oxide...pounds		(a)		(a)
Mineral paints...short tons	66,033	2,161,461	71,973	2,979,158
Zinc oxide...do	74,680	5,999,375	71,784	6,490,660
Asbestos...do	1,695	28,565	653	11,899
Asphalt...do	138,059	1,290,340	223,861	2,826,489
Bauxite...long tons	75,332	368,311	97,776	480,330
Chromic iron ore...do	107	1,800	290	5,640
Feldspar...short tons	75,656	401,531	84,544	499,069
Fibrous talc...do	61,672	557,200	67,800	626,000
Fuller's earth...do	32,040	265,400	32,851	291,773
Glass sand...do	1,089,430	1,208,788	1,187,296	1,250,067
Graphite: crystalline...pounds	5,887,982	238,064	4,947,840	171,149
Graphite: amorphous...short tons	16,853	102,175	26,803	125,821
Magnesite...do	7,805	23,415	7,561	22,683
Manganese ores...long tons	6,921	88,132	5,604	63,369
Manganiferous ores...do	41,300	122,400	103,844	259,473
Mica: sheet...pounds	1,423,100	252,248	1,060,182	349,311
Mica: scrap...short tons	1,489	22,742	3,025	42,800
Mineral waters...gallons sold	48,108,580	8,028,387	52,060,520	7,331,503
Monazite and zircon...pounds	847,275	152,560	548,152	65,800
Precious stones		[b]589,000		[b]735,800
Pumice...short tons	12,200	16,750	8,112	33,818
Quartz...do	66,697	243,012	22,977	157,094
Rutile...pounds				(a)
Sand, molding, etc., and gravel...short tons	31,842,572	11,489,420	40,664,622	13,242,002
Talc and soapstone...do	58,972	874,356	72,010	905,047
Tungsten...do	928	348,867	1,640	890,048
Uranium and vanadium...do		(a)		(a)
Total value of nonmetallic mineral products		1,017,696,178		1,167,705,720
Total value of metallic products		886,110,856		903,802,244
Estimated value of mineral products unspecified		200,000		100,000
Grand total		1,904,007,034		2,071,607,964

[a] Included under unspecified.

[b] Includes pearls valued at $381,000 in 1906 and at $264,500 in 1907.

Mineral products of the United States for the calendar years 1880–1909—Continued.

Product.	1908.	
	Quantity.	Value.
METALS.		
Pig iron (spot value) long tons.	15,936,018	$254,321,000
Silver, commercial value troy ounces.	52,440,800	28,050,600
Gold, coining value do.	4,574,340	94.560,000
Copper, value at New York City pounds.	942.570,721	124,419,335
Lead, value at New York City short tons.	310,762	26,104,008
Zinc, value at St. Louis do.	190,749	17,930,406
Quicksilver, spot value flasks.	19,752	824,146
Aluminum pounds.	11,152,000	2,434,600
Antimony short tons.	....	....
Antimonial lead do.	13,629	1,264,771
Nickel, value at Philadelphia pounds.	....	(*a*)
Tin do.	....	....
Platinum, value at New York City troy ounces.	750	14,250
Total value of metals	....	549,923,116
NONMETALS (SPOT VALUE).		
Bituminous coal short tons.	332,573,944	374,135,268
Pennsylvania anthracite long tons.	74,347,102	158,178,849
Natural gas	....	54,640,374
Petroleum barrels.	178,527,355	129,079,184
Peat	....	133,000
Clay products	....	133,197,762
Cement barrels.	52,910,925	44,477,653
Lime short tons.	2,766,873	11,091,186
Sand (molding, building, etc.), and gravel do.	36,122,491	12,135,433
Sand-lime brick	....	1,029,699
Slate	....	6,316,817
Stone	....	65,712,499
Corundum and emery short tons.	669	8,745
Garnet for abrasive purposes do.	1,996	64,620
Grindstones	....	536,095
Infusorial earth and tripoli short tons.	....	97,442
Millstones	....	31,420
Oilstones, etc	....	217,284
Pumice short tons.	10,569	39,287
Arsenious oxide pounds.	....	(*a*)
Borax (crude) short tons.	25,000	975,000
Bromine pounds.	1,055,636	102,344
Fluorspar short tons.	38,795	225.998
Gypsum do.	1,721,829	4,075,824
Lithium minerals do.	203	1,550
Marls do.	8,469	4,330
Phosphate rock long tons.	2,386,138	11,399,124
Pyrite do.	222,598	857,113
Sulphur do.	369,444	6,668,215
Salt barrels.	28,822,062	7,553,632
Barytes (crude) short tons.	38,527	120,442
Cobalt oxide pounds.	....	(*a*)
Mineral paints short tons.	68,694	2,410,367
Zinc oxide do.	56,292	5,072,460
Asbestos do.	936	19,624
Asphalt do.	198,382	2,057,881
Bauxite long tons.	52,167	263,968
Chromic iron ore do.	359	7,230
Feldspar short tons.	70,474	428,553
Fuller's earth do.	29,714	278,367
Gems and precious stones	....	415,063
Glass sand short tons.	1,093,553	1,134,599
Graphite (crystalline) pounds.	2,288,000	132,840
Graphite (amorphous) short tons.	1,443	75,250
Magnesite do.	6,587	19,761
Manganese ores long tons.	6,144	62,779
Manganiferous ores do.	55,620	132,556
Mica (sheet) pounds.	972,964	234,021
Mica (scrap) short tons.	2,417	33,904
Mineral waters gallons sold.	55,868,820	6,712,680
Quartz short tons.	47,316	190,157
Talc and soapstone do.	46,615	703,832
Talc, fibrous do.	70,739	697,390
Thorium minerals (monazite), and zircon pounds.	422,646	50,718
Titanium ores (rutile) do.	....	....
Tungsten ores short tons.	671	229,955
Uranium and vanadium minerals do.	....	....
Total value of nonmetals	....	1,044,470,144
Total value of metals	....	549,923,116
Estimated value of mineral products unspecified *a*	....	250,000
Grand total	....	1,594,643,260

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a Included under unspecified.

Mineral products of the United States for the calendar years 1880–1909—Continued.

Product.	1909.	
	Quantity.	Value.
METALS.		
Pig iron (spot value)...long tons	25,795,471	$419,175,000
Silver, commercial value...troy ounces	54,721,500	28,455,200
Gold, coining value...do	4,821,701	99,673,400
Copper, value at New York City...pounds	1,092,951,624	142,083,711
Lead, value at New York City...short tons	354,188	30,460,168
Zinc, value at St. Louis...do	230,225	24,864,300
Quicksilver, spot value...flasks	21,075	888,710
Aluminum...pounds	34,210,000	6,575,000
Antimony...short tons		
Antimonial lead...do	12,896	1,231,019
Nickel, value at Philadelphia...pounds		(a)
Tin...do		4,832
Platinum, value at New York City...troy ounces	638	15,950
Total value of metals		753,427,290
NONMETALS (SPOT VALUE).		
Bituminous coal...short tons	379,744,257	405,486,777
Pennsylvania anthracite...long tons	72,374,249	149,415,847
Natural gas		63,206,941
Petroleum...barrels	182,134,274	128,248,783
Peat		174,269
Clay products		166,321,213
Cement...barrels	65,399,889	52,797,973
Lime...short tons	3,472,852	13,805,405
Sand (molding, building, etc.) and gravel...do	58,461,100	17,173,615
Sand-lime brick		1,150,580
Slate		5,441,418
Stone		71,345,199
Corundum and emery...short tons	1,580	18,185
Garnet for abrasive purposes...do	2,972	102,315
Grindstones		804,051
Infusorial earth and tripoli...short tons		122,348
Millstones		35,393
Oilstones, etc		214,019
Pumice...short tons	15,103	33,439
Arsenious oxide...pounds	2,428,000	52,946
Borax (crude)...short tons	41,434	1,534,365
Bromine...pounds	728,875	92,735
Fluorspar...short tons	50,742	291,747
Gypsum...do	2,252,785	5,906,738
Lithium minerals...do		(a)
Marls...do	21,814	45,053
Phosphate rock...long tons	2,330,152	10,772,120
Pyrite...do	247,070	1,028,157
Sulphur...do	239,312	4,432,066
Salt...barrels	30,117,646	8,343,831
Barytes (crude)...short tons	58,377	198,561
Cobalt oxide...pounds		(a)
Mineral paints...short tons	79,688	2,419,710
Zinc oxide...do	68,974	6,156,755
Asbestos...do	3,085	62,603
Asphalt...do	228,655	2,138,273
Bauxite...long tons	129,101	679,447
Chromic iron ore...do	598	8,300
Feldspar...short tons	76,539	401,788
Fuller's earth...do	33,486	301,604
Gems and precious stones		534,380
Glass sand...short tons	1,104,451	1,163,375
Graphite (crystalline)...pounds	6,294,400	313,271
Graphite (amorphous)...short tons	5,096	32,238
Magnesite...do	9,465	37,860
Manganese ores...long tons	1,544	19,675
Manganiferous ores...do	68,654	215,925
Mica (sheet)...pounds	1,809,582	234,482
Mica (scrap)...short tons	4,090	46,047
Mineral waters...gallons sold	64,674,486	6,894,134
Quartz...short tons	135,469	249,466
Talc and soapstone...do	81,802	862,002
Talc, fibrous...do	48,536	359,957
Thorium minerals (monazite) and zircon...pounds	543,931	65,282
Titanium ores (rutile)...do		10,000
Tungsten ores...short tons	1,619	614,370
Uranium and vanadium minerals...do		(a)
Total value of nonmetals		1,132,417,033
Total value of metals		753,427,290
Estimated value of mineral products unspecified [a]		300,000
Grand total		1,886,144,323

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[a] Included under unspecified.

OUTPUT AND VALUE, BY STATES AND TERRITORIES, OF THE MINERAL PRODUCTS OF THE UNITED STATES IN THE CALENDAR YEARS 1907, 1908, AND 1909.

In the following table are shown the quantity and the value, by States and Territories, of the mineral products of the United States in 1907, 1908, and 1909.

The values for gold and silver are the official figures agreed upon by the United States Geological Survey and the Director of the Mint. The figures for the tonnage (not the value) of pig iron in 1907, 1908, and 1909 are taken from the annual reports prepared by Mr. James M. Swank, general manager of the American Iron and Steel Association.[a]

The figures for the year 1907 are retained in order to show the more plainly the results of the financial panic of that year.

Output and value, by States and Territories, of the mineral products of the United States in the calendar years 1907, 1908, and 1909.

ALABAMA.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Clay products		$1,754,409		$1,559,606		$1,700,127
Coal ... short tons	14,250,454	18,405,468	11,604,593	14,647,891	13,703,450	16,306,236
Copper ... pounds		(b)		(d)		
Gold ... fine ounces (troy)	1,325	27,400	1,993	41,200	1,413	29,200
Graphite ... short tons	715	54,000	453	33,750		(d)
Iron, pig ... long tons	1,686,674	30,100,000	1,397,014	17,341,000	1,763,617	22,222,000
Lime ... short tons	85,909	368,902	83,411	325,234	75,268	290,059
Mica				9,810		(d)
Mineral waters ... gallons sold	130,800	20,720	99,192	31,583	116,645	28,595
Natural gas		(c)		(d)		(d)
Sand and gravel ... short tons	311,659	169,872	348,134	181,179	611,778	214,396
Silver ... fine ounces (troy)	600	400	400	200	200	100
Stone		828,847		627,011		(d)
Other products		[d] 406,740		[d] 212,344		[d] 1,191,495
Total		52,136,749		35,010,808		41,982,208

ALASKA.

Coal ... short tons		(e)	3,107	$14,810	2,800	$12,300
Copper ... pounds	7,034,763	$1,406,953	4,438,836	585,926	4,057,142	527,428
Gold ... fine ounces (troy)	894,424	18,489,400	960,669	19,858,800	983,928	20,339,600
Lead ... short tons					60	5,160
Silver ... fine ounces (troy)	179,300	118,300	204,600	109,400	198,600	103,300
Stone		38,110		[f] 40,343		(g)
Other products		[g] 147,789		[g] 182,459		[g] 207,130
Total		20,200,552		20,791,738		21,194,918

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[a] Ann. Statist. Rept. Am. Iron and Steel Association for the years 1907, 1908, and 1909.

[b] Included under Miscellaneous.

[c] Included under Texas.

[d] Includes in 1907: Bauxite, mica, Portland and puzzolan cement, pyrite, sand-lime brick; in 1908: Bauxite, Portland and puzzolan cement, copper, natural gas, pyrite; in 1909: Bauxite, Portland and puzzolan cement, fuller's earth, graphite, mica, millstones, natural gas, pyrite, stone.

[e] Included under California.

[f] Includes small value for Nevada.

[g] Includes in 1907: Graphite, gypsum, tin, mineral waters; in 1908: Graphite, gypsum, lead, marble; in 1909: Graphite, gypsum, stone.

Output and value, by States and Territories, of the mineral products of the United States in the calendar years 1907, 1908, and 1909—Continued.

ARIZONA.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Clay products		$101,462		$104,992		$107,940
Copper...pounds	256,778,437	51,355,687	289,523,267	38,217,071	291,110,298	37,844,339
Gold...fine ounces (troy)	128,871	2,664,000	120,937	2,500,000	127,071	2,626,800
Lead...short tons	2,340	248,040	1,464	122,976	1,465	125,990
Lime...do	12,825	84,262	10,819	68,635	12,473	84,223
Gems and precious stones		21,280		25,700		46,667
Silver...fine ounces (troy)	2,903,100	1,916,000	2,900,000	1,551,200	2,523,600	1,312,300
Stone		237,110		451,832		(*a*)
Tungsten ore		10,769		6,000		(*a*)
Zinc...short tons	77	9,086	152	14,288	2,862	309,096
Other products		*a* 105,994		*a* 440,140		*a* 698,111
Total		56,753,650		43,502,834		43,155,466

ARKANSAS.

Clay products		$536,286		$508.788		$627,024
Coal...short tons	2,670,438	4,473,693	2,078,357	3,499,470	2,377,157	3,523,139
Fuller's earth...do		(*b*)		(*b*)	2,314	18,313
Gems and precious stones		2,800		2,100		2,033
Glass sand...short tons	43	32	2,065	1,297		(*b*)
Lead...do	15	1.590			14	1,204
Lime...do	33,472	159,566	27,179	122.290	28,065	133,025
Manganiferous ores...long tons	4,133	8,266	4,066	9,149		(*b*)
Mineral waters...gallons sold	431,511	85,236	1,175,053	212,835	1,213,742	153.163
Natural gas		(*c*)		(*b*)		(*b*)
Oilstones				81,837		72,334
Sand and gravel...short tons	165,070	81,645	249,922	87,555	1,084,805	249,734
Slate		8,500		2,500		
Stone		315,478		257,001		330.603
Zinc...short tons	1,911	225,498	2,002	188,188	135	14,580
Other products		*b* 488,157		*b* 359,472		*b* 764.177
Total		6,386,747		5,332,482		5,889,329

CALIFORNIA.

Asphalt...short tons	131,068	$1,213,957	135,241	$1,347,257	127,115	$926,848
Borax...do	52,850	1,121,520	25,000	975,000	41,434	1,534,365
Cement, Portland...barrels		(*d*)		(*d*)	3,936,581	5,899,784
Chromite...long tons	290	5,640	359	7,230		(*d*)
Clay products		5,740,537		4,523,745		4,437,165
Coal...short tons	*d* 24,089	91,813	18,755	54,840	45.836	95.042
Copper...pounds	33,696,602	6,739,320	39,643,835	5,232,986	53,568,708	6,963,932
Gems and precious stones		173,715		168,438		239,690
Glass sand...short tons	11,064	8,179	6,805	5,121		(*d*)
Gold...fine ounces (troy)	815,288	16,853,500	935,074	19,329,700	1,001,537	20,703,600
Gypsum		141,675		(*d*)		(*d*)
Lead...short tons	854	90,524	515	43,260	937	80,582
Lime...do	84,981	691,851	70,913	581,481	62,942	528.373
Magnesite...do	7,561	22.683	6,587	19,761	9,465	37,860
Manganese ores...long tons	100	600				(*d*)
Mineral waters...gallons sold	1,680,169	460.972	1,960,770	393,920	2,179,187	444,230
Natural gas		168.397		307,652		446,933
Ocher...short tons	450	3,970	335	2,250		(*d*)
Petroleum...barrels	39,748,375	14,699,956	44,854,737	23,433,502	54,433,010	30,675.267
Platinum...fine ounces (troy)	300	8,898	706	13,414	316	7,900
Pyrite...long tons	51,950	174,549	30,545	131,744	51,266	254,235

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[a] Includes in 1907: Asbestos, Portland cement, mineral waters, sand and gravel, sand-lime brick; in 1908: Asbestos, Portland cement, fluorspar, gypsum, quartz, quicksilver, sand and gravel, sand-lime brick; in 1909: Portland cement, fluorspar, gypsum, quartz, sand and gravel, stone, tungsten ore.

[b] Includes in 1907: Bauxite, fuller's earth, oilstones, phosphate rock, sand-lime brick; in 1908: Bauxite, fuller's earth, natural gas, phosphate rock, sand-lime brick; in 1909: Bauxite, glass sand, manganiferous ores, natural gas, phosphate rock, sand-lime brick.

[c] Included under Miscellaneous.

[d] Includes in 1907: Asbestos, Portland cement, infusorial earth, metallic paint, quartz, talc and soapstone, and tungsten ore; in 1908: Portland cement, fuller's earth, gypsum, infusorial earth, metallic paint, pig iron, tungsten ore; in 1909: Chromite, fuller's earth, feldspar, glass sand, gypsum, infusorial earth, manganese ore, metallic paint, ocher, slate, talc, tungsten ore.

Output and value, by States and Territories, of the mineral products of the United States in the calendar years 1907, 1908, and 1909—Continued.

CALIFORNIA—Continued.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Quicksilver.............flasks..	17,431	$662,544	16,984	$684,716	16,078	$658,688
Salt.................barrels..	626,693	302,940	899,028	374,828	886,564	558,889
Sand and gravel....short tons..	1,233,869	170,687	605,800	135,839	1,206,557	313,774
Sand-lime brick..................		63,150		56,494		30,056
Silver.......fine ounces (troy)..	1,590,000	1,049,400	1,703,700	911,300	2,304,900	1,198,500
Slate..........................		60,000		60,000		(a)
Stone..........................		3,134,429		3,291,585		3,444,900
Zinc...............short tons..	140	16,520	27	2,538		
Other products..................		[a] 2,817,510		[a] 2,943,083		[a] 464,465
Total....................		56,679,436		65,031,684		79,945,078

COLORADO.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Clay products..................		$2,041,475		$1,970,081		$2,049,024
Coal...............short tons..	10,790,236	15,079,449	9,634,973	13,586,988	10,716,936	14,296,012
Copper...............pounds..	13,998,496	2,799,699	13,943,878	1,840,592	11,485,631	1,493,132
Fluorspar..........short tons..	3,300	11,400	745	[b] 4,518	350	2,100
Gems and precious stones......		10,790		3,350		4,371
Glass sand.........short tons..	2,000	2,500	1,000	1,250		
Gold.......fine ounces (troy)..	1,010,921	20,897,600	1,106,385	22,871,000	1,056,829	21,846,600
Lead...............short tons..	48,876	5,180,856	28,728	2,413,152	29,326	2,522,036
Lime...................do....	5,679	28,798	5,615	28,179	5,024	26,935
Manganiferous ores..long tons..	99,711	251,207	51,554	123,407	65,024	209,495
Mica..........................				13,330		(d)
Mineral waters....gallons sold..	775,100	154,415	761,150	127,720	1,077,820	111,158
Natural gas....................		(c)		(d)		(d)
Petroleum.............barrels..	331,851	272,813	379,653	346,403	310,771	317,712
Sand and gravel....short tons..	66,456	22,573	22,731	9,326	402,693	95,381
Silver......fine ounces (troy)..	11,495,400	7,587,000	10,150,200	5,429,400	8,846,300	4,600,100
Stone..........................		869,328		[e] 740,253		(d)
Tungsten ore....................		573,643		204,465		391,160
Vanadium mineral..............		6,000				(d)
Zinc...............short tons..	26,077	3,077,086	24,885	2,339,190	20,121	2,173,068
Other products..................		[d] 12,237,596		[d] 6,576,883		[d] 9,051,690
Total....................		71,105,128		58,629,487		59,189,974

CONNECTICUT

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Feldspar...........short tons..			14,200	$66,259	13,644	$43,013
Gems and precious stones......		$133		(f)		350
Lime...................do....	81,433	$358,052	62,070	307,895	83,096	405,545
Mineral waters....gallons sold..	307,906	41,439	424,826	36,404	691,296	42,375
Quartz.............short tons..		(f)		(f)	9,583	51,521
Sand and gravel..........do....	29,815	26,193	13,657	8,420	15,759	12,482
Stone..........................		1,052,582		[g] 1,125,799		(f)
Other products..................		[f] 1,911,120		[f] 1,176,886		[f] 3,010,568
Total....................		3,389,519		2,721,663		3,565,854

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[a] Includes in 1907: Asbestos, Portland cement, infusoral earth, metallic paint, quartz, talc and soapstone, and tungsten ore; in 1908: Portland cement, fuller's earth, gypsum, infusorial earth, metallic paint, pig iron, tungsten ore; in 1909: Chromite, fuller's earth, feldspar, glass sand, gypsum, infusorial earth, manganese ore, metallic paint, ocher, slate, talc, tungsten ore.

[b] Includes Arizona.

[c] Included under Miscellaneous.

[d] Includes in 1907: Portland cement, fuller's earth, gypsum, graphite, mica, pig iron, sand-lime brick, sulphur, uranium, and zinc-lead; in 1908: Portland and natural cement, fluorspar, fuller's earth, graphite, gypsum, natural gas, pig iron, quartz, sand-lime brick, zinc-lead; in 1909: Portland cement, fuller's earth, graphite, grindstones, gypsum, mica, natural gas, pig iron, sand-lime brick, stone, vanadium mineral, zinc-lead.

[e] Includes small value for Missouri.

[f] Includes in 1907: Clay products, infusorial earth, pig iron, abrasive quartz and feldspar, metallic paint, quartz, gems and precious stones; in 1908: Clay products, infusorial earth, metallic paint, pig iron, quartz, abrasive quartz; in 1909: Clay products, infusorial earth, metallic paint, pig iron, stone.

[g] Includes small value for Rhode Island and Maine.

Output and value, by States and Territories, of the mineral products of the United States in the calendar years 1907, 1908, and 1909—Continued.

DELAWARE.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Clay products		$190,440		$146,527		$231,505
Sand and gravel....short tons	147,282	63,887	78,993	32,426	150,793	78,923
Stone		158,192		195,761		456,328
Other products		[a] 18,919		[a] 76,261		[a] 109,745
Total		431,438		450,975		876,501

DISTRICT OF COLUMBIA.

Clay products		$322,084		$268,600		$214,489
Other products		15,210		[b] 9,200		29,580
Total		337,294		277,800		244,069

FLORIDA.

Clay products		$354,575		$233,162		$298,620
Fuller's earth......short tons	22,960	213,620			22,218	203,236
Lime....do			11,822	62,915	11,558	50,569
Mineral waters....gallons sold	43,430	12,378	123,552	20,569	113,944	16,534
Phosphate rock......long tons	1,357,365	6,577,757	1,692,102	8,484,539	1,779,702	8,541,301
Sand and gravel ...short tons	15,798	6,609	28,176	17,901	43,566	28,611
Sand-lime brick		109,275		117,040		77,076
Stone		15,000		41,910		
Other products		76,540		189,726		23,544
Total		7,365,754		9,167,762		9,239,491

GEORGIA.

Clay products		$2,490,237		$1,928,611		$2,294,501
Coal.......short tons	[c] 362,401	499,686	264,822	364,279	211,196	298,792
Copper.......pounds		([d])				
Glass sand.........short tons	4,800	4,800	3,950	3,180		([e])
Gold.......fine ounces (troy)	3,135	64,800	2,719	56,200	2,099	43,400
Lead.......short tons	2	212				
Lime.......do	18,349	70,826	11,193	46,780	11,903	44,962
Mineral waters ...gallons sold	246,800	28,120	346,198	50,930	782,166	99,888
Ocher.......short tons	5,600	57,100	6,035	63,851	5,838	60,971
Sand and gravel.......do	226,290	81,991	225,897	77,808	434,276	206,263
Sand-lime brick		89,582		([e])		([e])
Silver......fine ounces (troy)	700	500	200	100	200	100
Stone		1,745,638		1,895,608		1,644,584
Talc and soapstone.short tons	739	11,473		([e])		([e])
Other products		[e] 1,496,038		[e] 713,534		[e] 887,182
Total		6,641,003		5,200,881		5,580,643

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[a] Includes in 1907: Mineral waters, sand-lime brick; in 1908: Sand-lime brick, etc.; in 1909: Mineral waters, sand-lime brick, etc.

[b] Includes in 1908: Mineral waters, pottery

[c] Includes North Carolina.

[d] Under Miscellaneous.

[e] Includes in 1907: Asbestos, barytes, bauxite, natural and Portland cement, fuller's earth, graphite, mica, pig iron, pyrite, gems and precious stones, tungsten ore; in 1908: Asbestos, barytes, bauxite, Portland and natural cement, fuller's earth, infusorial earth, mica, pig iron, pyrite, sand-lime brick, talc and soapstone; in 1909: Asbestos, barytes, bauxite, Portland and natural cement, fuller's earth, glass sand, graphite, infusorial earth, mica, pig iron, pyrite, sand-lime brick, slate, talc and soapstone.

Output and value, by States and Territories, of the mineral products of the United States in the calendar years 1907, 1908, and 1909—Continued.

IDAHO.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Coal.........short tons..	[a] 7,588	$31,119	5,429	$21,832	4,553	$19,459
Copper.........pounds..	9,707,299	1,941,460	7,256,086	957,803	7,096,132	922,497
Gold.......fine ounces (troy)..	60,754	1,255,900	69,829	1,443,500	65,026	1,344,200
Lead.........short tons..	112,569	11,932,314	98,464	8,270,976	97,183	8,357,738
Lime.........do....	5,964	49,022	7,373	57,020	12,631	81,463
Salt.........barrels..	1,600	2,040	1,114	1,413	793	1,118
Silver......fine ounces (troy)..	7,888,400	5,206,300	7,558,300	4,042,900	6,755,900	3,513,100
Stone.........	....	65,843	....	69,394	....	68,315
Zinc.........short tons..	3,508	413,944	581	54,614	901	97,308
Other products.........	....	[b] 402,670	....	[b] 336,930	....	[b] 503,621
Total.........	....	21,300,612	....	15,256,382	....	14,908,819

ILLINOIS.

Product.	1907. Quantity.	1907. Value.	1908. Quantity.	1908. Value.	1909. Quantity.	1909. Value.
Cement:						
Natural.........barrels..	284,599	$92,750	188,859	$68,772	....	(c)
Portland.........do....	2,036,093	2,632,576	3,211,168	2,707,044	4,241,392	$3,388,667
Clay products.........	....	13,220,489	....	11,559,114	....	14,344,453
Coal.........short tons..	51,317,146	54,687,382	47,659,690	49,978,247	50,904,990	53,522,014
Fluorspar.........do....	25,128	141,971	31,727	172,838	41,852	232,251
Glass sand.........do....	235,716	152,619	194,722	139,172	224,381	153,226
Infusorial earth.........	....	(c)	....	(c)	....	39,262
Iron, pig.........long tons..	2,457,768	52,229,000	1,691,944	30,135,000	2,467,156	44,211,000
Lead.........short tons..	498	52,788	363	30,492	273	23,478
Lime.........do....	124,784	559,305	92,549	393,951	104,260	454,682
Mineral waters....gallons sold..	720,400	91,760	685,763	58,904	639,460	49,108
Natural gas.........	....	143,577	....	446,077	....	644,401
Petroleum.........barrels..	24,281,973	16,432,947	33,685,106	22,648,881	30,898,339	19,788,864
Pyrite.........long tons..	....	(c)	....	(c)	5,600	17,551
Sand and gravel....short tons..	4,315,275	1,215,034	6,463,026	1,363,850	8,930,848	1,796,271
Silver......fine ounces (troy)..	2,900	1,900	2,000	1,100	900	500
Stone.........	....	3,789,342	....	3,134,770	....	4,261,818
Zinc.........short tons..	1,446	170,628	298	28,012	675	72,900
Other products.........	....	[c] 154,396	....	[c] 34,464	....	[c] 51,283
Total.........	....	145,768,464	....	122,900,688	....	143,051,729

INDIANA.

Product.	1907. Quantity.	1907. Value.	1908. Quantity.	1908. Value.	1909. Quantity.	1909. Value.
Cement:						
Natural.........barrels..	400,000	$140,000	212,901	$42,580	177,924	$52,647
Portland.........do....	3,782,841	4,757,860	6,478,165	5,386,563	[d] 5,736,255	[d] 4,518,878
Clay products.........	....	6,858,124	....	6,740,167	....	7,645,223
Coal.........short tons..	13,985,713	15,114,300	12,314,890	13,084,297	14,834,259	15,154,681
Glass sand.........do....	30,500	23,000	18,000	13,950	....	(e)
Lime.........do....	107,964	335,151	95,988	293,579	99,325	335,154
Mineral waters....gallons sold..	514,366	507,746	615,429	426,063	663,815	446,249
Natural gas.........	....	1,572,605	....	1,312,507	....	1,616,903
Oilstones.........	....	21,692	....	19,358	....	7,095
Petroleum.........barrels..	5,128,037	4,536,930	3,283,629	3,203,883	2,296,086	1,997,610
Sand and gravel....short tons..	5,588,392	784,718	3,255,955	681,858	4,436,986	892,832
Sand-lime brick.........	....	95,527	....	54,413	....	32,800
Stone.........	....	3,639,551	....	3,646,603	....	3,753.358
Other products.........	....	[e] 754,013	....	[e] 2,224,857	....	[e] 6,368,595
Total.........	....	39,141,217	....	37,130,678	....	42,822,025

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[a] Includes Nebraska and Nevada.

[b] Includes in 1907: Antimony, clay products, mica, mineral waters, phosphate rock, sand-lime brick; in 1908: Clay products, phosphate rock, sand-lime brick, stone; in 1909: Asbestos, clay products, mineral waters, phosphate rock, pumice, sand and gravel, sand-lime brick, tungsten ore.

[c] Includes in 1907: Puzzolan cement, infusorial earth, metallic paint, pyrite, quartz, sienna, umber, sand-lime brick; in 1908: Infusorial earth, pyrite, sand-lime brick; in 1909: Natural cement, etc.

[d] Add 1,289,826 barrels, valued at $812,590, to production of Portland cement in Indiana in 1909. Correction received too late for insertion.

[e] Includes in 1907: Pig iron, pyrite; in 1908: Pig iron, precious stones, pyrite; in 1909: Glass sand, pig iron, pyrite.

Output and value, by States and Territories, of the mineral products of the United States in the calendar years 1907, 1908, and 1909—Continued.

IOWA.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Clay products		$3,728,785		$4,069,497		$4,898,696
Coal.....short tons..	7,574,322	12,258,012	7,161,310	11,706,402	7,757,762	12,793,628
Gypsum.....do....		730,383		565,645		655,602
Lead.....do....	225	23,850	110	9,240	15	1,290
Lime.....do....	19,944	84,011	18,900	79,400	15,739	82,202
Mineral waters....gallons sold..	127,200	30,500	493,500	31,350	184,000	14,116
Sand and gravel....short tons..	461,784	110,501	773,512	286,444	1,530,904	458,829
Sand-lime brick		55,618		42,881		48,210
Stone		564,124		533,282		527,720
Zinc.....short tons..	220	25,960	516	48,504		
Other products		11,350		[a] 691,892		[a] 862,075
Total		17,623,094		18,074,537		20,342,368

KANSAS.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Cement, Portland.....barrels..	3,353,925	$4,240,358	3,854,603	$2,874,457	5,334,299	$3,792,764
Clay products		2,370,058		2,248,805		2,709,822
Coal.....short tons..	7,322,449	11,159,698	6,245,508	9,292,222	6,986,478	10,083,384
Gypsum.....do....		414,266		281,339		318,678
Lead.....do....	1,798	190,588	2,293	192,612	2,764	237,704
Lime.....do....	4,124	18,131	1,558	8,086	1,332	8,018
Mineral waters....gallons sold..	362,252	61,454	370,943	74,380	633,024	89,796
Natural gas		6,198,583		7,691,587		8,293,846
Petroleum.....barrels..	2,409,521	965,134	1,801,781	746,695	1,263,764	497,633
Salt.....do....	2,667,459	962,334	2,588,814	882,984	2,769,849	782,676
Sand and gravel....short tons..	556,625	117,313	320,150	64,328	977,918	188,708
Stone		860,579		471,126		911,895
Zinc.....short tons..	13,850	1,634,300	8,628	811,032	9,185	991,980
Other products		[b] 739,812		[b] 522,560		[b] 546,255
Total		29,932,608		26,162,213		29,447,159

KENTUCKY.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Asphalt.....short tons..	13,387	$92,465	11,539	$67,040	15,898	$85,005
Barytes.....do....			5,233	21,504		(c)
Clay products		2,611,364		2,239,108		2,478,872
Coal.....short tons..	10,753,124	11,405,038	10,246,553	10,317,162	10,697,384	10,079,917
Fluorspar.....do....	21,058	133,911	6,323	48,642	7,800	53,233
Glass sand.....do....	7,400	4,592	5,990	4,283		(c)
Lead.....do....	75	7,950				
Lime.....do....	4,670	14,945	6,206	21,322	4,331	13,741
Mineral waters....gallons sold..	736,920	72,373	797,186	66,112	756,425	73,767
Natural gas		380,176		424,271		485,192
Petroleum.....barrels..	[d] 820,844	862,396	727,767	706,811	639,016	518,299
Sand and gravel....short tons..	429,392	259,358	632,308	331,497	760,857	429,568
Stone		1,002,450		893,447		(c)
Zinc.....short tons..	358	42,244	341	32,054	22	2,376
Other products		[c] 2,405,079		[c] 968,703		[c] 2,626,002
Total		19,294,341		16,141,956		16,845,972

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[a] Includes in 1908: Ocher, Portland cement, slate, etc.; in 1909: Portland cement, natural gas, ocher, slate, and shale.

[b] Includes in 1907: Natural cement, sand-lime brick, zinc-lead, zinc oxide; in 1908: Natural cement, pottery, pumice, sand-lime brick, zinc-lead, zinc oxide; in 1909: Natural cement, pottery, sand-lime brick, zinc-lead, zinc oxide.

[c] Includes in 1907: Barytes, natural, Portland, and puzzolan cement, infusorial earth, pig iron, ocher, sand-lime brick; in 1908: Portland and natural cement, ocher, pig iron, sand-lime brick; in 1909: Barytes, Portland and natural cement, glass sand, oilstones, pig iron, sand-lime brick, stone.

[d] Includes Tennessee.

Output and value, by States and Territories, of the mineral products of the United States in the calendar years 1907, 1908, and 1909—Continued.

LOUISIANA.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Clay products		$928,570		$629,924		$528,261
Glass sand.........short tons			2,695	1,911		
Mineral waters....gallons sold			400,500	52,020	1,375,000	103,850
Natural gas		(a)		(b)		(b)
Petroleum.........barrels	5,000,221	4,063,033	5,788,874	3,503,419	3,059,531	2,022,449
Salt.........do	1,157,621	226,892	947,129	249,733		(c)
Sand and gravel....short tons	1,233,750	442,924	814,745	251,402	651,144	302,618
Other products		[b] 5,215,300		[b] 6,796,846		[b] 4,701,263
Total		10,876,719		11,485,255		7,658,441

MAINE.

Clay products		$658,913		$542,730		$635,667
Feldspar.........short tons			13,919	123,409	18,137	166,031
Gems and precious stones		1,100		(d)		15,086
Gold				198		
Lime.........short tons	159,494	764,140	141,934	661,453	178,564	957,690
Mineral waters....gallons sold	1,161,832	414,300	1,182,322	394,346	1,515,541	402,593
Silver				167		
Slate		236,606		213,707		
Stone		2,147,770		2,027,508		227,882
Zinc.........short tons	1	118				(d)
Other products		[d] 172,319		[d] 81,160		[d] 1,971,539
Total		4,395,266		4,044,678		4,376,488

MARYLAND.

Clay products		$1,886,362		$1,441,099		$1,720,812
Coal.........short tons	5,532,628	6,623,697	4,377,093	5,116,753	4,023,241	4,471,731
Copper.........pounds		(e)		(f)		
Feldspar.........short tons			9,734	51,850	6,564	35,399
Glass sand.........do	13,370	13,215	14,000	13,700		(f)
Iron, pig.........long tons		(f)		(f)	286,856	4,673,000
Lime.........short tons	103,423	324,316	103,224	292,623	125,436	367,945
Mineral waters....gallons sold	1,023,562	110,039	806,673	75,858	938,496	91,569
Sand and gravel....short tons	574,389	254,833	788,234	390,466	446,679	183,393
Slate		116,060		102,186		129,538
Stone		1,439,355		968,437		(f)
Talc and soapstone.short tons	5,067	32,250		(f)		(f)
Other products		[f] 8,555,121		[f] 3,036,090		[f] 1,208,187
Total		19,356,250		11,489,062		12,881,574

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[a] Included under Texas.

[b] Includes in 1907: Mineral waters, sulphur; in 1908: Natural gas, sulphur; in 1909: Natural gas, pottery, stone, sulphur.

[c] Included under New York.

[d] Includes in 1907: Feldspar, mica, sand and gravel; in 1908: Mica, pottery, gems and precious stones, sand and gravel; in 1909: Mica, pottery, sand and gravel, stone.

[e] Under Miscellaneous.

[f] Includes in 1907: Natural cement, infusorial earth, feldspar, pig iron, sand-lime brick, abrasive quartz, quartz, metallic paint and mortar colors; in 1908: Portland cement, copper, infusorial earth, metallic paint and mortar colors, pig iron, quartz, abrasive quartz, sand-lime brick, talc and soapstone; in 1909: Portland cement, glass sand, metallic paint and mortar colors, quartz, sand-lime brick, stone, talc and soapstone, umber.

Output and value, by States and Territories, of the mineral products of the United States in the calendar years 1907, 1908, and 1909—Continued.

MASSACHUSETTS.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Clay products		$2,128,820		$1,647,362		$1,887,886
Coal short tons			50	150		
Copper pounds			7,863	1,038		
Gems and precious stones		100				250
Glass sand short tons	7,500	37,734	5,017	25,330		(a)
Lime do	119,072	596,778	107,813	566,022	136,546	709,128
Mineral waters gallons sold	4,661,115	208,579	4,395,049	227,907	5,424,682	228,067
Sand and gravel short tons	193,259	103,543	154,031	89,849	328,309	191,013
Stone		3,218,979		2,955,195		(a)
Talc and soapstone short tons					9,057	48,729
Other products		[a] 289,648		[a] 413,096		[a] 3,714,901
Total		6,584,181		5,925,949		6,779,974

MICHIGAN.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Cement, Portland barrels	3,572,668	$4,384,731	2,892,576	$2,556,215	3,212,751	$2,619,259
Clay products		1,847,764		1,728,790		2,042,498
Coal short tons	2,035,858	3,660,833	1,835,019	3,322,904	1.784,692	3,199,351
Copper pounds	219,131,503	43,826,301	222,289,584	29,342,225	227,005,923	29,510,770
Gems and precious stones						2,700
Glass sand short tons	4,300	8,600	17,000	34,000	65,000	79,000
Gold						
Gypsum		681,351		491,928		1,213,347
Lime short tons	65,822	276,534	68,050	282,023	83,108	354,135
Mineral waters gallons sold	1,472,679	127,133	2,004,433	88,910	2,760,604	104,454
Salt barrels	10,786,630	2,231,129	10,194,279	2,458,303	9,966,744	2,732,556
Sand and gravel short tons	1,020,341	280,995	825,591	336,365	2,154,757	606,632
Sand-lime brick		172,840		138,809		218,226
Silver fine ounces (troy)	331,300	218,700	294,100	157,300	217,600	113,100
Stone		813,336		708,120		(b)
Other products		[b] 11,712,445		[b] 4,084,906		[b] 2,154,778
Total		70,242,692		45,730,798		44,950,806

MINNESOTA.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Clay products		$1,689,933		$1,508,710		$1,755,438
Gems and precious stones						100
Gold				1,265		
Lime short tons	20,450	88,900	19,800	85,700	43,841	215,568
Mineral waters gallons sold	9,654,030	524,800	10,985,536	551,986	13,746,142	614,291
Sand and gravel short tons	417,692	130,350	450,306	156,659	1,339,039	332,162
Sand-lime brick				71,041		113,069
Silver				5		
Stone		1,582,126		1,493,706		(c)
Other products		[c] 1,441,313		[c] 654,950		[c] 2,657,492
Total		5,457,422		4,524,022		5,688,120

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[a] Includes in 1907: Bromine, abrasive quartz, emery, feldspar, fuller's earth, infusorial earth, pig iron, pyrite, quartz, salt, talc; in 1908: Portland cement, emery, fuller's earth, infusorial earth, pig iron, pyrite, abrasive quartz, talc and soapstone; in 1909: Portland cement, feldspar, fuller's earth, glass sand, graphite infusorial earth, pig iron, pyrite, quartz, stone.

[b] Includes in 1907: Bromine, graphite, grindstones, oilstones, petroleum, pig iron; in 1908: Graphite, grindstones, oilstones, petroleum, pig iron, gems and precious stones; in 1909: Bromine, graphite, grindstones, metallic paint, natural gas, oilstones, petroleum, pig iron, quartz, stone.

[c] Includes in 1907: Natural cement, abrasive feldspar, feldspar, pig iron, sand-lime brick; in 1908: Feldspar, Portland cement, pig iron, pottery; in 1909: Natural cement, pig iron, pottery, stone.

Output and value, by States and Territories, of the mineral products of the United States in the calendar years 1907, 1908, and 1909—Continued.

MISSISSIPPI.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Clay products	....	$846,529	....	$828,739	....	$798,350
Mineral waters....gallons sold	425,500	93,350	257,200	52,780	307,315	52,925
Sand and gravel....short tons	169,415	75,863	162,577	82,119	517,338	269,364
Other products	....	8,560	....	10,880	....	9,000
Total	....	1,024,302	....	974,518	....	1,129,639

MISSOURI.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Barytes....short tons	44,039	$162,459	16,319	$56,768	34,815	$119,818
Cement, Portland....barrels	....	....	2,929,504	2,571,236	3,445,076	2,808,916
Clay products	....	6,898,871	....	5,631,456	....	7,440,183
Coal....short tons	3,997,936	6,540,709	3,317,315	5,444,907	3,756,530	6,183,626
Copper....pounds	....	(a)	....	(b)	....	(b)
Glass sand....short tons	138,483	92,898	111,517	83,106	98,480	73,082
Gold....fine ounces (troy)	....	....	....	....	10	200
Infusorial earth	....	....	....	(b)	....	66,557
Lead....short tons	122,856	13,022,736	122,451	10,285,884	142,650	12,267,900
Lime....do	190,300	877,970	167,060	701,321	182,460	815,367
Mineral waters....gallons sold	667,232	103,314	682,821	86,043	765,032	111,448
Natural gas	....	17,010	....	22,592	....	10,025
Sand and gravel....short tons	2,936,797	698,076	2,476,641	643,878	4,229,772	928,249
Silver....fine ounces (troy)	25,300	16,700	49,400	26,400	15,200	7,900
Stone	....	2,325,611	....	2,306,058	....	2,295,763
Sublimed blue lead....short tons	9,911	1,162,232	1,311	121,923	....	(b)
Sublimed white lead....short tons			9,100	973,700	....	(b)
Zinc....do	141,824	16,735,232	123,655	11,623,570	140,676	15,193,008
Other products	....	b 4,475,613	....	b 920,993	....	b 2,094,001
Total	....	53,129,431	....	41,499,835	....	50,416,043

MONTANA.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Clay products	....	$272,872	....	$387,525	....	$451,389
Coal....short tons	2,016,857	3,907,082	1,920,190	3,771,248	2,553,940	5,036,942
Copper....pounds	224,263,789	44,852,758	252,503,651	33,330,481	314,858,291	40,931,578
Gems and precious stones	....	229,800	....	58,397	....	44,998
Gold....fine ounces (troy)	167,987	3,472,600	152,865	3,160,000	181,411	3,750,100
Lead....short tons	2,035	215,710	2,320	194,880	1,376	118,336
Lime....do	4,217	25,340	5,121	32,981	4,540	27,713
Silver....fine ounces (troy)	11,129,600	7,345,500	10,356,200	5,539,500	12,034,500	6,257,900
Stone	....	265,956	....	c 225,709	....	(d)
Tungsten ore	....	32,700	....	....	....	....
Zinc....short tons	....	....	900	84,600	4,725	510,300
Other products	....	d 43,193	....	d 18,520	....	d 363,550
Total	....	60,663,511	....	46,803,841	....	57,492,806

NEBRASKA.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Clay products	....	$953,432	....	$946,516	....	$1,146,449
Coal	....	(e)	....	....	....	....
Mineral waters....gallons sold	....	....	48,498	11,047	....	(f)
Sand and gravel....short tons	374,590	54,227	526,966	80,428	786,608	119,902
Stone	....	324,239	....	338,070	....	293,830
Other products	....	f 52,018	....	f 49,327	....	f 39,637
Total	....	1,383,916	....	1,425,388	....	1,599,818

[a] Under Miscellaneous.

[b] Includes in 1907: Portland cement, grindstones, cobalt oxide, petroleum, pig iron, tripoli, zinc-lead; in 1908: Copper, infusorial earth, petroleum, pig iron; in 1909: Cobalt oxide, copper, nickel, petroleum, pig iron, sublimed blue lead, sublimed white lead.

[c] Includes small value for Idaho and Michigan.

[d] Includes in 1907: Arsenic, grindstones, mineral waters, sand and gravel; in 1908: Arsenic, grindstones, pottery, quartz, sand and gravel, sand-lime brick; in 1909: Arsenic, gypsum, mineral waters, pottery, sand and gravel, sand-lime brick, stone.

[e] Included under Idaho.

[f] Includes in 1907: Mineral waters, pumice, sand-lime brick; in 1908: Pumice, sand-lime brick, tungsten ore; in 1909: Mineral waters, pumice, sand-lime brick.

Output and value, by States and Territories, of the mineral products of the United States in the calendar years 1907, 1908, and 1909—Continued.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
NEVADA.						
Coal		(*a*)				
Copper.....pounds..	1,998,164	$399,633	12,241,372	$1,615,861	53,849,281	$7,000,407
Gems and precious stones		5,525		61,000		120,518
Gold.....fine ounces (troy)..	745,507	15,411,000	565 475	11 689,400	792,682	16,386,200
Lead.....short tons..	3,380	358,280	3,796	318,864	4,698	404,028
Salt.....barrels..	6,457	3,654	9,714	4,785	16,107	19,847
Silver.....fine ounces (troy)..	8,280,500	5,465,100	9,508,500	5,086,100	10,119,200	5,262,000
Zinc.....short tons..	1,692	199,656	398	37,412	825	89,100
Other products		[b] 245,852		[b] 230,398		[b] 346,726
Total		22,088,700		19,043,820		29,628,826
NEW HAMPSHIRE.						
Clay products		$510,599		$371,640		$55,2215
Copper.....pounds..			135,139	17,838		(*c*)
Gold.....fine ounces (troy)..			179	3,700		
Mica		7,227		(*c*)		16,180
Mineral waters.....gallons sold..	343,500	164,943	835,349	235,520	934,072	245,607
Silver.....fine ounces (troy)..			6,300	3,400	3,000	1,600
Stone		647,721		867,028		1,215,461
Other products		[c] 59,870		[c] 91,151		[c] 125,922
Total		1,390,360		1,590,277		2,156,985
NEW JERSEY.						
Cement, Portland.....barrels..	4,449,896	$4,738,516	3,208,446	$2,416,009	4,046,322	$2,813,162
Clay products		16,005,460		12,313,696		17,172,094
Gems and precious stones						335
Glass sand.....short tons..	87,140	73,914	56,775	46,379	85,696	62,830
Iron, pig.....long tons..	373,189	7,554,000	225,372	3,370,000	294,474	4,473,000
Lime.....short tons..	34,043	167,149	32,700	134,722	38,014	146,401
Marls.....do....	14,091	8,429		(*d*)		
Mineral waters.....gallons sold..	982,445	103,082	1,199,023	126,603	1,419,500	127,025
Sand and gravel.....short tons..	2,124,696	971,345	2,083,686	665,799	2,605,018	872,543
Sand-lime brick		22,792		20,819		21,925
Slate		8,000		(*d*)		(*d*)
Stone		1,523,312		1,531,740		1,613,861
Zinc.....short tons..	13,573	1,601,614	6,926	651,044	16,035	1,731,780
Other products		[d] 22,686		[d] 38,820		[d] 595,447
Total		32,800,299		21,315,631		29,630,403
NEW MEXICO.						
Clay products		$180,284		$140,671		$182,755
Coal.....short tons..	2,628,959	3,832,128	2,467,937	3,368,753	2,801,128	3,619,744
Copper.....pounds..	10,140,140	2,028,028	4,991,351	658,858	5,031,136	654,048
Gems and precious stones		1,570		72,100		25,636
Gold.....fine ounces (troy)..	15,964	330,000	14,817	306,300	12,229	252,800
Lead.....short tons..	1,927	204,262	586	49,224	1,275	109,650
Lime.....do....	485	3,866		(*e*)	2,640	14,200
Mineral water.....gallons sold..	65,800	9,120	152,200	16,060	157,700	28,839
Sand and gravel.....short tons..	209,478	50,724	8,250	12,050	4,902	3,032
Silver.....fine ounces (troy)..	599,500	395,700	400,900	214,500	324,200	168,600
Stone		381,011		15,955		300,313
Tungsten ore		4,320		(*e*)		
Zinc.....short tons..	136	16,048	134	12,596	3,961	427,788
Other products		[e] 80,782		[e] 70,823		[e] 83,142
Total		7,517,843		4,937,890		5,870,547

[a] Included under Idaho.

[b] Includes in 1907: Antimony, clay products, graphite, gypsum, infusorial earth, lime, sulphur; in 1908: Clay products, graphite, gypsum, lime, sulphur; in 1909: Clay products, graphite, gypsum, lime, quicksilver, sand and gravel, stone, sulphur.

[c] Includes in 1907: Gems and precious stones, whetstones; in 1908: Mica, pottery, gems and precious stones, whetstones; in 1909: Copper, lead, pottery, whetstones.

[d] Includes in 1907: Graphite, talc and soapstone; in 1908: Marls, slate, ground slate and shale, talc and soapstone; in 1909: Marl, slate, slate and shale, talc and soapstone, zinc oxide.

[e] Includes in 1907: Gypsum, mica, salt; in 1908: Graphite, gypsum, lime, mica, pottery, salt, tungsten ore; in 1909: Fluorspar, gypsum, pottery, salt.

Output and value, by States and Territories, of the mineral products of the United States in the calendar years 1907, 1908, and 1909—Continued.

NEW YORK.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Cement, natural........barrels..	947.929	$633,170	623,618	$441,136	545,500	$267,188
Portland............do....	2,290,955	2,433,918	1,988,874	1,813,623	2,139,884	1,859,169
Clay products		11,772,874		8,929,224		12,157,436
Emery.............short tons..		(*a*)		(*a*)	1,580	[b]18,185
Feldspar.................do....			14,613	53,148	11,603	33,101
Garnet, abrasive.........do....			1,996	64,620	2,972	[c]102,315
Glass sand...............do....			5,000	3,500		(*a*)
Graphite..............pounds..			1,932,000	116,100	2,498,400	138,905
Gypsum		800,225		760,759		1,032,650
Iron, pig............long tons..	1,659,752	33,097,000	1,019,495	15,879,000	1,733,675	27,392,000
Lime..............short tons..	137,111	652,205	106,025	529,501	124,594	542,274
Metallic paint and mortar colors..................do....	6,394	70,771	7,048	65,482	8,244	79,072
Millstones		23,072		18,341		13,138
Mineral waters....gallons sold..	7,176,815	686,574	8,007,092	855,148	8,813,563	948,325
Natural gas		766,157		959,280		1,222,666
Petroleum.............barrels..	1,212,300	2,127,748	1,160,128	2,071,533	1,134,897	1,878,217
Salt.....................do....	9,642,178	2,335,150	9.076,743	2,136,738	10,914,255	[d]2,646,736
Sand and gravel....short tons..	5,254,896	1,767,521	3,701,388	1,349,163	6,394,615	1,822,314
Sand-lime brick		75,462		57,189		90,402
Slate		83,485		(*a*)		107,436
Stone		6,993,705		6,157,279		5,660,598
Talc, fibrous.......short tons..	67,800	626,000	70,739	697,390	48,536	359,957
Other products		[a]533,156		[a]2,689,207		[a]6,780,720
Total		68,762,815		45,647,361		65,152,804

NORTH CAROLINA.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Barytes............short tons..	5,785	$18,855		(*e*)		(*e*)
Clay products		1,315,822		$943,968		$1,302,611
Coal		(*f*)				
Copper...............pounds..	544,040	108,808	29,391	3,880	120,451	15,659
Gems and precious stones		7,580		(*e*)		479
Gold.......fine ounces (troy)..	3,807	78,700	4,716	97,500	1,519	31,400
Lime..............short tons..	5,000	24,010	5,132	24,750	9,881	44,148
Mica		225,206		127,870		148,424
Millstones		1,969		4,052		(*e*)
Mineral waters....gallons sold..	193,479	40,302	160,195	27,163	128,171	20,558
Monazite and zircon ..pounds..	457,067	54,870	310,196	37,224	391,068	47,178
Sand and gravel....short tons..	4,745	2,191	7,123	2,070	89,181	13,358
Sand-lime brick		38,808		14,000		(*e*)
Silver......fine ounces (troy)..	25,200	16,600	1,300	700	400	200
Stone		932,909		800,177		806,659
Talc and soapstone.short tons..	4,085	74,347	3,564	51,443	5,956	77,983
Other products		[e]20,404		[e]11,150		[e]43,261
Total		2,961,381		2,145,947		2,551,918

NORTH DAKOTA.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Clay products		$287,919		$206,222		$269,324
Coal...............short tons..	347,760	560,199	320,742	522,116	422,047	645,142
Natural gas		235		2,480		3,025
Stone		3,260		(*g*)		(*h*)
Other products		[h]23,567		[h]8,000		[h]28,563
Total		875,180		738,818		946,054

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[a] Includes in 1907: Arsenic, aluminum, puzzolan cement, emery, feldspar, graphite, abrasive garnet, infusorial earth, pyrite, quartz, sienna, shale; in 1908: Aluminum, emery, infusorial earth, marl, gems and precious stones, pyrite, quartz, abrasive quartz, slate, slate and shale; in 1909: Aluminum, glass sand, infusorial earth, marl, mica, pyrite, quartz, slate and shale, zinc oxide.

[b] Includes small output from Massachusetts.

[c] Includes very small output from North Carolina.

[d] Includes Louisiana.

[e] Includes in 1907: Abrasive garnet, quartz, tin; in 1908: Barytes, gems and precious stones; in 1909: Barytes, millstones, sand-lime brick.

[f] Included under Georgia.

[g] Included under Oregon.

[h] Includes in 1907: Natural cement, sand-lime brick; in 1908: Sand-lime brick, etc.; in 1909: Mineral waters, sand and gravel, sand-lime brick, stone.

Output and value, by States and Territories, of the mineral products of the United States in the calendar years 1907, 1908, and 1909—Continued.

OHIO.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Cement, Portland.....barrels..	1,151,176	$1,377,155	1,521,764	$1,305,210	1,813,521	$1,359,245
Clay products..................	....	30,340,830	....	26,622,490	....	30,346,241
Coal...............short tons..	32,142,419	35,324,746	26,270,639	27,897,704	27,639,641	27,789,010
Glass sand...............do....	95,449	104,127	92,487	94,825	88,054	95,331
Grindstones and pulpstones....	....	764,276	....	482,128	....	679,930
Iron, pig...........long tons..	5,250,687	106,387,000	2,861,325	47,353,000	5,551,545	99,521,000
Lime...............short tons..	322,917	1,239,912	279,080	975,661	343,754	1,241,719
Mineral waters....gallons sold..	1,536,621	121,531	2,409,598	124,938	2,709,060	112,775
Natural gas.....................	....	8,718,562	....	8,244,835	....	9,966,938
Petroleum.............barrels..	12,207,448	14,769,888	10,858,797	14,178,502	10,632,793	13,225,377
Pyrite..............long tons..	6,816	20,803	6,531	19,929	9,461	29,003
Salt...................barrels..	3,851,243	979,078	3,427,478	864,710	3,684,775	993,700
Sand and gravel....short tons..	2,883,352	1,411,910	2,404,223	1,043,553	3,927,319	1,497,965
Sand-lime brick.................	....	11,283	....	(a)	....	(a)
Stone............................	....	5,157,970	....	4,764,309	....	[a] 5,659,052
Other products..................	....	[a] 928,268	....	[a] 527,541	....	697,206
Total..................	....	207,657,339	....	134,499,335	....	193,214,492

OKLAHOMA.

Product.	1907 Quantity.	1907 Value.	1908 Quantity.	1908 Value.	1909 Quantity.	1909 Value.
Asphalt............short tons..	5,038	$20,770	2,402	$23,820	10,419	$48,130
Clay products..................	....	664,512	....	562,929	....	1,032,314
Coal...............short tons..	3,642,658	7,433,914	2,948,116	5,976,504	3,119,377	6,253,367
Lead.....................do....	404	42,824	1,409	118,356	2,268	195,048
Mineral waters....gallons sold..	69,725	7,345	534,114	52,779	563,475	35,194
Natural gas.....................	....	417,221	....	860,159	....	1,806,193
Petroleum.............barrels..	43,524,128	17,513,524	45,798,765	17,694,843	47,859,218	17,428,990
Salt...................barrels..	800	$910	....	(b)	....	(b)
Sand and gravel....short tons..	108,560	22,506	119,940	$35,971	681,785	185,812
Stone............................	....	274,326	....	337,429	....	577,494
Zinc...............short tons..	719	84,842	2,235	210,090	3,008	324,864
Other products..................	....	[b] 426,274	....	[b] 713,871	....	[b] 1,120,732
Total..................	....	26,908,968	....	26,586,751	....	29,008,138

OREGON.

Product.	1907 Quantity.	1907 Value.	1908 Quantity.	1908 Value.	1909 Quantity.	1909 Value.
Clay products..................	....	$545,839	....	$555,768	....	$827,963
Coal...............short tons..	70,981	166,304	86,259	236,021	87,276	235,085
Copper.................pounds..	518,694	103,739	271,191	35,797	245,403	31,902
Gold.......fine ounces (troy)..	59,124	1,222,200	43,823	905,900	40,103	829,000
Lead...............short tons..	....	....	7	588	6	516
Lime.....................do....	4,095	39,738	3,274	28,795	3,205	29,305
Mineral waters....gallons sold..	24,225	5,556	25,350	8,830	41,100	10,720
Natural gas.....................	....	100	....	250	....	(d)
Platinum...fine ounces (troy)..	57	1,691	44	836	222	5,550
Sand and gravel....short tons..	504,142	289,422	616,034	524,984	896,989	79,705
Silver.......fine ounces (troy)..	96,000	63,400	56,100	30,000	69,600	36,200
Stone............................	....	127,279	....	[c] 286,414	....	(d)
Other products..................	....	[d] 73,419	....	[d] 129,251	....	[d] 427,793
Total..................	....	2,638,587	....	2,743,434	....	2,813,739

[a] Includes in 1907: Bromine, natural and puzzolan cement, gypsum, metallic paint and mortar colors, oilstones; in 1908: Natural and puzzolan cement, gypsum, metallic paint and mortar colors, oilstones, sand-lime brick; in 1909: Bromine, natural and puzzolan cement, gypsum, metallic paint, oilstones, sand-lime brick.

[b] Includes in 1907: Gypsum, lime; in 1908: Portland cement, gypsum, salt; in 1909: Bromine, Portland cement, gypsum, lime, salt.

[c] Includes small value for North Dakota.

[d] Includes in 1907: Cobalt oxide, gypsum, gems and precious stones; in 1908: Gypsum, pottery, quicksilver; in 1909: Gypsum, natural gas, pottery, quicksilver.

Output and value, by States and Territories, of the mineral products of the United States in the calendar years 1907, 1908, and 1909—Continued.

PENNSYLVANIA.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Cement:						
Natural.....barrels	625,871	$263,969	252,479	$87,192	295,085	$98,673
Portland.....do	20,393,965	19,698,006	18,254,806	13,899,807	22,869,614	15,969,621
Clay products		20,291,621		14,842,982		21,186,713
Coal:						
Anthracite.....long tons	76,432,421	163,584,056	74,347,102	158,178,849	72,374,249	149,415,847
Bituminous.....short tons	150,143,177	155,664,026	117,179,527	118,816,303	137,966,791	130,085,237
Feldspar.....do			14,089	103,502	18,573	111,466
Gems and precious stones						150
Glass sand.....short tons	370,977	489,989	405,028	484,353	281,120	399,707
Gold.....fine ounces (troy)					300	6,200
Graphite.....pounds	1,674,000	51,960	356,000	16,740	2,098,000	116,466
Iron, pig.....long tons	11,348,549	234,952,000	6,987,191	111,385,000	10,918,824	179,355,000
Lime.....short tons	655,166	2,075,842	582,352	1,883,496	885,239	2,542,954
Metallic paint and mortar colors.....do	10,327	127,973	9,197	113,112	16,174	196,067
Millstones		2,016		1,073		(*a*)
Mineral waters.....gallons sold	1,287,063	235,807	1,430,489	180,889	2,177,967	240,856
Natural gas		18,844,156		19,104,944		20,475,207
Ocher.....short tons	8,047	76,816	9,286	78,956	5,989	58,003
Petroleum.....barrels	9,999,306	17,579,706	9,424,325	16,881,194	9,299,403	15,424,554
Sand and gravel.....short tons	5,428,471	2,292,579	3,725,414	1,718,703	4,918,627	2,113.363
Sand-lime brick		48,410		64,123		62,255
Slate		3,855,640		3,902,958		2,892,358
Stone		9,132,372		6,371,152		8,125,723
Other products		*a* 6,874,095		*a* 4,951,276		*a* 5,167,682
Total		657,783 345		473,066,604		554,044,102

RHODE ISLAND.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Mineral waters.....gallons sold	245,307	$17,108	594,208	$39,405	502,970	$35,438
Stone		674,898		556,474		(*b*)
Other products		*b* 245,378		*b* 112,815		*b* 1,168,440
Total		937,384		708,694		1,203,878

SOUTH CAROLINA.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Clay products		$843,379		$615,248		$753,004
Glass sand.....short tons	3,000	2,400	1,970	1,596		(*c*)
Gold.....fine ounces (troy)	2,811	58,100	2,598	53,700	358	7,400
Manganese ores.....long tons	800	4,800				
Mica		13,935		2,899		
Mineral waters.....gallons sold	786,754	195,182	271,572	70,937	372,880	95,885
Monazite.....pounds	91,085	10,930	112,450	13,494	150,863	18,104
Phosphate rock.....long tons	257,221	980,867	225,495	989,881	207,954	910,586
Sand and gravel.....short tons	2,824	2,018	4,434	1,814	299,659	34,514
Silver.....fine ounces (troy)	100	100	200	100		
Stone		129,377		297,874		218,045
Other products		*c* 64,115		*c* 33,458		*c* 53,884
Total		2,305,203		2,081,001		2,091,422

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a Includes in 1907: Bromine, aluminum, puzzolan cement, abrasive garnet, abrasive quartz, feldspar, gems and precious stones, quartz salt, sienna, shale, talc, umber, zinc oxide; in 1908: Aluminum, puzzolan cement quartz abrasive quartz salt sienna, slate and shale, talc, umber, zinc oxide; in 1909: Bromine, puzzolan cement, copper millstones, pyrite, quartz, salt, slate and shale, sienna, talc, umber, zinc oxide.

b Includes in 1907: Clay products, lime, talc; in 1908: Clay products, lime, talc; in 1909: Clay products, lime, stone, talc, soapstone.

c Includes in 1907: Fuller's earth, lime, quartz, tin; in 1908: Copper, fuller's earth, lime; in 1909: Glass sand, lime, marl.

Output and value, by States and Territories, of the mineral products of the United States in the calendar years 1907, 1908, and 1909—Continued.

SOUTH DAKOTA.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Clay products		$40,107		$63,847		$68,660
Copper.......pounds					41,988	5,458
Gems and precious stones		5,200		([a])		2,520
Gold.......fine ounces (troy)	200,185	4,138,200	374,529	7,742,200	317,998	6,573,600
Lead.......short tons			13	1,092		
Lime.......do	3,673	24,895	5,254	34,068	5,309	35,982
Natural gas		19,500		24,400		16,164
Silver.......fine ounces (troy)	106,600	70,400	197,300	105,500	196,300	102,100
Stone		155,875		131,994		([a])
Tin						4,832
Other products		[a]484,652		[a]425,133		[a]795,171
Total		4,938,829		8,528,234		7,604,487

TENNESSEE.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Barytes.......short tons	20,861	$37,138	8,618	$12,313		([d])
Clay products		1,613,862		1,236,434		$1,648,872
Coal.......short tons	6,810,243	8,490,334	6,199,171	7,118,499	6,358,645	6,920,564
Copper.......pounds	19,475,119	3,895,024	19,710,103	2,601,734	19,207,747	2,497,007
Gold.......fine ounces (troy)	184	3,800	179	3,700	708	4,300
Iron, pig.......long tons	393,106	7,542,000	290,826	4,011,000	333,845	4,647,000
Lead.......short tons	16	1,696				
Lime.......do	66,699	263,323	73,016	226,463	78,620	245,724
Manganese ores.......long tons	100	1,500				([d])
Mineral waters.......gallons sold	758,312	85,249	712,912	68,693	934,912	76,185
Natural gas		300		350		350
Petroleum.......barrels		([b])				
Phosphate rock.......long tons	638,612	3,047,836	455,431	1,877,221	333,003	1,286,193
Sand and gravel.......short tons	794,364	313,211	797,334	360,074	911,462	416,473
Silver.......fine ounces (troy)	58,300	38,500	60,900	32,600	65,300	33,900
Stone		1,090,121		[c]1,310,651		1,163,915
Zinc.......short tons	181	21,358	341	32,054	695	75,060
Other products		[d]79,752		[d]385,245		[d]679,573
Total		26,525,004		19,277,031		19,695,116

TEXAS.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Asphalt.......short tons	53,649	$929,857	30,167	$519,440	46,304	$857,204
Cement, Portland.......barrels					656,361	808,997
Clay products		2,557,561		2,066,735		3,148,463
Coal.......short tons	1,648,069	2,778,811	1,895,377	3,419,481	1,824,440	3,141,945
Copper.......pounds					3,456	449
Gems and precious stones						234
Gold.......fine ounces (troy)	48	1,000	24	500	19	400
Lead.......short tons	10	1,060	42	3,528	42	3,612
Lime.......do	38,101	186,372	33,725	144,118	53,578	244,845
Mineral waters.......gallons sold	1,146,279	152,233	1,586,634	151,032	1,033,476	98,499
Natural gas		[e]178,276		([f])		([f])
Petroleum.......barrels	12,322,696	10,410,865	11,206,464	6,700,708	9,534,467	6,793,050
Quicksilver.......flasks	3,686	148,387	2,382	122,260	4,188	194,084
Salt.......barrels	356,086	226,540	442,571	255,652	409,315	260,286
Sand and gravel.......short tons	283,484	142,294	309,250	140,067	676,506	246,365
Silver.......fine ounces (troy)	305,300	201,500	447,000	239,100	408,100	212,200
Stone		497,962		659,574		([f])
Zinc.......short tons	16	1,888				
Other products		[f]1,391,854		[f]959,734		[f]1,207,174
Total		19,806,458		15,381,929		17,217,807

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[a] Includes in 1907: Portland cement, gypsum, mica, mineral waters, sand-lime brick, sand and gravel, tin, tantalum; in 1908: Portland cement, copper, gypsum, lithium minerals, mica, gems and precious stones, sand and gravel, sand-lime brick, tungsten ore; in 1909: Portland cement, columbite, gypsum, mica, mineral waters, sand and gravel, sand-lime brick, stone.

[b] Included under Kentucky.

[c] Includes small value for Virginia.

[d] Includes in 1907: Bauxite, metallic paint and mortar colors; in 1908: Bauxite, Portland cement, metallic paint and mortar colors, quartz, slate and shale; in 1909: Barytes, bauxite, Portland cement, glass sand, manganese ore, metallic paint and mortar colors, quartz.

[e] Includes Alabama and Louisiana.

[f] Includes in 1907: Natural and Portland cement, fuller's earth, gypsum, pig iron, gems and precious stones, sand-lime brick; in 1908: Portland and natural cement, copper, fuller's earth, gypsum, natural gas, pig iron, gems and precious stones, sand-lime brick; in 1909: Natural cement, fuller's earth, gypsum, natural gas, pig iron, sand-lime brick, stone.

Output and value, by States and Territories, of the mineral products of the United States in the calendar years 1907, 1908, and 1909—Continued.

UTAH.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Asphalt...short tons..	20,719	$569,440	19,033	$100,324	28,919	$221,086
Clay products...		633,387		658,517		874,159
Coal...short tons..	1,947,607	2,959,769	1,846,792	3,119,338	2,266,899	3,751,810
Copper...pounds..	66,418,370	13,283,674	71,370,370	9,420,889	101,241,114	13,161,345
Gems and precious stones...		9,500		20,350		25,713
Gold...fine ounces (troy)..	247,758	5,121,600	190,922	3,946,700	203,818	4,213,300
Lead...short tons..	61,699	6,540,094	42,455	3,566,220	64,534	5,549,924
Lime...do...	12,671	68,085	12,237	78,340	16,388	116,992
Quicksilver...flasks..	450	18,000				
Salt...barrels..	345,557	199,779	242,678	169,833	246,935	147,318
Silver...fine ounces (troy)..	11,406,900	7,528,500	8,451,300	4,520,600	10,551,100	5,486,600
Stone...		338,382		286,414		([a])
Zinc...short tons..	1,972	232,696	282	26,508	5,960	643,680
Other products...		[a] 596,852		[a] 508,082		[a] 1,087,583
Total...		38,099,756		26,422,121		35,279,510

VERMONT.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Clay products...		$109,500		$89,064		$83,360
Copper...pounds..	696,102	139,220				
Lime...short tons..	47,369	254,281	32,691	170,205	42,369	209,941
Mineral waters...gallons sold..	88,550	19,948	107,800	16,380	66,100	13,326
Ocher...short tons..		([b])	188	2,050	492	4,726
Sand and gravel...do...	78,734	33,410	80,906	41,636	82,090	8,752
Silver...fine ounces (troy)..	3,800	2,500				
Slate...		1,477,259		1,710,491		1,841,589
Stone...		7,313,739		7,152,624		6,324,366
Talc and soapstone.short tons..	16,200	82,500	10,755	99,743	23,626	120,329
Other products...		[b] 32,500		[b] 30,936		[b] 70,540
Total...		9,464,857		9,313,129		8,676,929

VIRGINIA.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Barytes...short tons..	9,254	$32,833		([c])		([c])
Clay products...		1,611,335		$1,499,130		$1,956,517
Coal...short tons..	4,710,895	4,807,533	4,259,042	3,868,524	4,752,217	4,251,056
Copper...pounds..	57,008	11,402	25,087	3,312	231,971	30,156
Gems and precious stones...		520				2,500
Glass sand...short tons..	1,246	4,535				
Gold...fine ounces (troy)..	402	8,300	174	3,600	194	4,000
Iron, pig...long tons..	478,771	8,963,000	320,458	4,578,000	391,134	5,683,000
Lead...short tons..	82	8,692	13	1,092		
Lime...do...	115,155	447,307	107,209	424,374	164,695	627,946
Manganese ores...long tons..	4,604	56,469	6,144	62,779		([c])
Mica...		1,014		7,346		4,600
Millstones...		4,684		7,954		([c])
Mineral waters...gallons sold..	2,442,075	431,770	2,009,614	207,115	1,504,530	203,455
Pyrite...long tons..	124,740	372,586	116,340	435,522	114,176	423,283
Sand and gravel...short tons..	266,976	119,277	449,234	119,095	847,476	281,177
Silver...fine ounces (troy)..	200	100	300	200	6,400	3,300
Slate...		173,670		194,356		180,775
Stone...		760,488		602,072		859,480
Talc and soapstone.short tons..	26,278	631,880	19,616	458,252	26,511	523,942
Zinc...do...	771	90,978	910	85,540	58	6,264
Other products...		[c] 774,809		[c] 569,132		[c] 761,254
Total...		19,313,182		13,127,395		15,802,705

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[a] Includes in 1907: Antimony, Portland cement, gypsum, mineral waters, petroleum, phosphate rock, sand and gravel, sulphur; in 1908: Bismuth, Portland cement, gypsum, petroleum, phosphate rock, sand and gravel, sulphur; in 1909: Arsenic, bismuth, Portland cement, graphite, gypsum, mineral waters, petroleum, phosphate rock, pottery, sand and gravel, stone, sulphur.

[b] Includes in 1907: Ocher, oilstones; in 1908: Asbestos, metallic paints, scythestones, umber; in 1909: Asbestos, metallic paints and mortar colors, oilstones.

[c] Includes in 1907: Natural and Portland cement, feldspar, gypsum, ocher, rutile, sand-lime brick; in 1908: Barytes, Portland cement, feldspar, gypsum, metallic paint, ocher, pottery salt, sand-lime brick; in 1909: Barytes, Portland cement, feldspar, gypsum, manganese ore, manganiferous ore, millstones, ocher, rutile, salt, sand-lime brick.

Output and value, by States and Territories, of the mineral products of the United States in the calendar years 1907, 1908, and 1909—Continued.

WASHINGTON.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Clay products		$1,921,934		$2,104,289		$3,060,486
Coal..short tons	3,680,532	7,679,801	3,024,943	6,690,412	3,602,263	9,158,999
Copper..pounds	122,263	24,453	162,201	21,411	120,611	15,679
Gems and precious stones						50
Gold..fine ounces (troy)	12,689	262,300	12,273	253,700	20,753	429,000
Lead..short tons	281	29,786	391	32,844	115	9,890
Lime..do	35,913	238,568	32,343	228,353	39,270	282,628
Mineral waters..gallons sold	68,400	10,820	38,900	13,650	39,260	15,958
Sand and gravel..short tons	403,960	179,800	654,995	261,531	1,253,632	423,425
Silver..fine ounces (troy)	84,000	55,400	86,800	46,400	75,200	39,100
Stone		920,254		1,367,191		(a)
Tungsten		32,500				
Other products		[a] 262,090		[a] 590,443		[a] 2,048,671
Total		11,617,706		11,610,224		15,483,886

WEST VIRGINIA.

Product.	1907. Quantity.	1907. Value.	1908. Quantity.	1908. Value.	1909. Quantity.	1909. Value.
Clay products		$3,640,387		$3,261,736		$3,510,097
Coal..short tons	48,091,583	47,846,630	41,897,843	40,009,054	51,849,220	44,661,716
Glass sand..do	171,338	225,003	145,782	174,834	169,731	205,102
Iron, pig..long tons	291,066	6,454,000		(b)	228,282	3,835,000
Lime..short tons	107,895	290,298	91,747	202,664	89,569	279,263
Mineral waters..gallons sold	135,809	79,659	130,295	64,540	233,349	64,730
Natural gas		16,670,962		14,837,130		17,538,565
Petroleum..barrels	9,095,296	15,852,428	9,523,176	16,911,865	10,745,092	17,642,283
Salt..do	156,147	76,527	145,157	70,481	150,492	76,463
Sand and gravel..short tons	333,246	160,435	222,860	101,524	386,714	217,136
Stone		1,053,867		772,534		(b)
Other products		[b] 137,764		[b] 1,044,000		[b] 1,147,104
Total		92,487,960		77,450,362		89,177,459

WISCONSIN.

Product.	1907. Quantity.	1907. Value.	1908. Quantity.	1908. Value.	1909. Quantity.	1909. Value.
Clay products		$1,127,819		$958,395		$1,139,589
Glass sand..short tons	2,970	1,930	3,750	2,812		(c)
Lead..do	3,551	376,406	4,013	337,092	3,238	278,468
Lime..do	219,644	733,996	235,538	831,792	268,250	1,067,500
Mineral waters..gallons sold	6,839,219	1,526,703	6,084,571	1,239,907	6,101,882	1,132,239
Sand and gravel..short tons	964,689	278,464	858,297	309,943	1,514,433	412,019
Stone		2,492,141		2,850,920		2,694,308
Zinc..short tons	15,273	1,802,214	17,538	1,648,572	20,381	2,201,148
Other products		[c] 5,494,652		[c] 2,699,518		[c] 5,924,350
Total		13,832,395		10,878,951		14,849,621

[a] Includes in 1907: Antimony, arsenic, Portland cement, gems and precious stones, sand-lime brick; in 1908: Arsenic, Portland cement, pig iron, sand-lime brick; in 1909: Arsenic, Portland cement, metallic paint and mortar colors, sand-lime brick, stone.

[b] Includes in 1907: Bromine, Portland cement, grindstones; in 1908: Pig iron, etc.; in 1909: Bromine, Portland cement, grindstones, stone.

[c] Includes in 1907: Natural cement, graphite, metallic paint and mortar colors, petroleum, pig iron, abrasive quartz, sand-lime brick; in 1908: Natural cement, graphite, metallic paint and mortar colors, pig iron, pyrite, quartz, abrasive quartz, sand-lime brick, zinc lead, zinc oxide; in 1909: Natural cement, glass sand, graphite, metallic paint and mortar colors, pig iron, pyrite, quartz, sand-lime brick, zinc-lead, zinc oxide.

Output and value, by States and Territories, of the mineral products of the United States in the calendar years 1907, 1908, and 1909—Continued.

WYOMING.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Clay products		$$88,340		$$52,282		$$67,755
Coal.......short tons	6,252,990	9,732,668	5,489,902	8,868,157	6,393,109	9,896,848
Copper.......pounds	3,026,004	605,201	2,416,197	318,938	433,672	56,377
Gems and precious stones		600				
Gold.......fine ounces (troy)	455	9,400	368	7,600	189	3,900
Gypsum		125,033		94,935		132,719
Lime.......short tons	282	3,220	392	4,246	226	2,756
Natural gas		(a)		(b)		(b)
Silver.......fine ounces (troy)	1,600	1,100	3,500	1,900	1,800	900
Stone		51,262		72,947		37,476
Other products		[b] 54,750		[b] 32,336		[b] 134,208
Total		10,671,574		9,453,341		10,332,939

MISCELLANEOUS PRODUCTS.

Product.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Includes in 1907: Antimony, copper, lead, antimonial lead, lime, lithium minerals, natural gas, pearls, pottery, stone; in 1908: Bromine, copper, abrasive feldspar, gold, lead, antimonial lead, lime, and stone (Hawaii), mineral waters, peat, silver; in 1909: Antimonial lead, copper, gold, lead, lime, peat, platinum, pottery, salt (Hawaii and Porto Rico), sand and gravel, silver, stone (Hawaii), tungsten ores		$2,521,543		$2,157,066		$2,155,683

RECAPITULATION.

	1907.	1908.	1909.	Gain (+) or loss (−).	Percentage of gain (+) or loss (−).
Alabama	$52,136,749	$35,010,808	$41,982,208	+ $6,971,400	+19.91
Alaska	20,200,552	20,791,738	21,194,918	+ 403,180	+ 1.94
Arizona	56,753,650	43,502,834	43,155,466	− 347,368	− .80
Arkansas	6,386,747	5,332,482	5,889,329	+ 556,847	+10.44
California	56,679,436	65,031,684	79,945,078	+ 14,913,394	+22.93
Colorado	71,105,128	58,629,487	59,189,974	+ 560,487	+ .96
Connecticut	3,389,519	2,721,663	3,565,854	+ 844,191	+31.02
Delaware	431,438	450,975	876,501	+ 425,526	+94.36
District of Columbia	337,294	277,800	244,069	− 33,731	−12.14
Florida	7,365,754	9,167,762	9,239,491	+ 71,729	+ .78
Georgia	6,641,003	5,200,881	5,580,643	+ 379,762	+ 7.30
Idaho	21,300,612	15,256,382	14,908,819	− 347,563	− 2.28
Illinois	145,768,464	122,900,688	143,051,729	+ 20,151,041	+16.40
Indiana	39,141,217	37,130,678	42,822,025	+ 5,691,347	+15.33
Iowa	17,623,094	18,074,537	20,342,368	+ 2,267,831	+12.55
Kansas	29,932,608	26,162,213	29,447,159	+ 3,284,946	+12.56
Kentucky	19,294,341	16,141,956	16,845,972	+ 704,016	+ 4.36
Louisiana	10,876,719	11,485,255	7,658,441	− 3,826,814	−33.32
Maine	4,395,266	4,044,678	4,376,488	+ 331,810	+ 8.20
Maryland	19,356,250	11,489,062	12,881,574	+ 1,392,512	+12.12
Massachusetts	6,584,181	5,925,949	6,779,974	+ 854,025	+14.41
Michigan	70,242,692	45,730,798	44,950,806	− 779,992	− 1.71
Minnesota	5,457,422	4,524,022	5,688,120	+ 1,164,098	+25.73
Mississippi	1,024,302	974,518	1,129,639	+ 155,121	+15.91
Missouri	53,129,431	41,499,835	50,416,043	+ 8,916,208	+21.48
Montana	60,663,511	46,803,841	57,492,806	+ 10,688,965	+22.84
Nebraska	1,383,916	1,425,388	1,599,818	+ 174,430	+12.24

[a] Included under miscellaneous.

[b] Includes in 1907: Mineral waters, petroleum, phosphate rock, sand and gravel, sulphur; in 1908: Natural gas, petroleum, phosphate rock, sand and gravel, sulphur; in 1909: Asbestos, chromite, mineral waters, natural gas, petroleum, phosphate rock, sand and gravel, sulphur.

Output and value, by States and Territories, of the mineral products of the United States in the calendar years 1907, 1908, and 1909—Continued.

RECAPITULATION—Continued.

	1907.	1908.	1909.	Gain (+) or loss (−).	Percentage of gain (+) or loss (−).
Nevada	$22,088,700	$19,043,820	$29,628,826	+$10,585,006	+55.58
New Hampshire	1,390,360	1,590,277	2,156,985	+ 566,708	+35.64
New Jersey	32,800,299	21,315,631	29,630,403	+ 8,314,772	+39.01
New Mexico	7,517,843	4,937,890	5,870,547	+ 932,657	+18.89
New York	68,762,815	45,647,361	65,152,804	+ 19,505,443	+42.73
North Carolina	2,961,381	2,145,947	2,551,918	+ 405,971	+18.92
North Dakota	875,180	738,818	946,054	+ 207,236	+28.05
Ohio	207.657,339	134,499,335	193,214,492	+ 58,715,157	+43.65
Oklahoma	26,908,968	26,586,751	29,008,138	+ 2,421,387	+ 9.11
Oregon	2,638,587	2,743,434	2,813,739	+ 70,305	+ 2.56
Pennsylvania	657,783,345	473,066,604	554,044,102	+ 80,977,498	+17.12
Rhode Island	937,384	708,694	1,203,878	+ 495,184	+69.87
South Carolina	2,305,203	2,081,001	2,091,422	+ 10,421	+ .50
South Dakota	4,938,829	8,528,234	7,604,487	− 923,747	−10.83
Tennessee	26,525,004	19,277,031	19,695,116	+ 418,085	+ 2.17
Texas	19,806,458	15,381,929	17,217,807	+ 1,835,878	+11.94
Utah	38,099,756	26,422,121	35,279,510	+ 8,857,389	+33.52
Vermont	9,464,857	9,313,129	8,676,929	− 636,200	− 6.83
Virginia	19,313,182	13,127,395	15,802,705	+ 2,675,310	+20.38
Washington	11,617,706	11,610,224	15,483,886	+ 3,873,662	+33.36
West Virginia	92,487,960	77,450,362	89,177,459	+ 11,727,097	+15.14
Wisconsin	13,832,395	10,878,951	14,849,621	+ 3,970,670	+36.50
Wyoming	10,671,574	9,453,341	10,332,939	+ 879,598	+ 9.30
Total	2,068,986,421	1,592,236,194	1,883,689,079	+291,452,885	+18.30
Miscellaneous	2,521,543	2,157,066	2,155,683	− 1,383	− .06
Unspecified products	100,000	250,000	300,000	+ 50,000	+20.00
Grand total	2,071,607,964	1,594,643,260	1,886,144,762	+291,501,502	+18.28

IMPORTS AND EXPORTS.

The following table shows the value for the calendar years 1907, 1908, and 1909 of the imports for consumption and of the exports of the mineral products included in this report as furnished by the Bureau of Statistics of the Department of Commerce and Labor. As has been noted elsewhere, "imports for consumption" may or may not be identical with "total imports" for the calendar year. Thus total imports valued at $500,000 may all be entered for consumption, or $50,000 of these imports may be entered in bond and be reported for consumption in the following calendar year. These differences tend to equalize. Thus in the five years from 1903 to 1907, inclusive, the general imports of iron ores exceeded the imports for consumption by less than 7,500 long tons in total imports of over 4,603,000 tons. The difference for a single year may, however, be considerable.

The imports of nonmetallic products increased $40,405,250, or 56.71 per cent, from $71,244,055 in 1908 to $111,649,305 in 1909, while the exports decreased $3,344,058, or 1.95 per cent, from $171,379,161 to $168,035,103. The total imports of mineral products, metallic and nonmetallic, increased $137,926,823, or 45.5 per cent, while the exports in 1909 were almost exactly the same as in 1908, the difference in the total of over $270,000,000 being $29,591. That the United States had not in 1909 entirely recovered from the effects of the preceding year is shown by the fact that the imports of mineral products in 1909, although 45.5 per cent over those of 1908, were still $17,000,000 short of the value of the products imported in 1907, but that the prospect for the future is bright is exhibited in the fact that more than 40 per cent of the total value of the imported mineral products was represented by precious stones. Of all the metals imported copper represented the largest increase in value, which in 1909 amounted to $9,098,878, or about 30 per cent, over the imports in 1908. The imports of copper represented 43 per cent of the total value of all the metals imported into the United States. Outside of the imports of precious stones the principal imports of nonmetallic products in 1909 were of pottery products, coal-tar products, and fertilizers. The value of pottery imported in 1909 was $10,607,212, as compared with $10,522,791 in 1908. Coal-tar products imported increased from $5,840,125 to $8,086,099, the imports in the year 1909 exceeding those of 1907. Potassium salts increased from $5,623,752 to $7,877,955, the imports of this fertilizer in 1909 being also in excess of those for 1907. Sodium nitrate imports increased from $11,424,760 to $13,332,548. Guano increased from $92,659 to $772,674, and miscellaneous fertilizers from $1,801,073 to $5,099,059.

Value of imports for consumption and of exports of mineral products in the calendar years 1907, 1908, and 1909.

METALS.

Product.	1907.	1908.	1909.	Increase (+) or decrease (−).
IMPORTS.				
Aluminum salts	$35,191	$24,929	$29,061	+ $4,132
Antimony (metal, regulus, and ore)	1,588,764	878,136	714,366	− 163,770
Antimony salts	98,038	65,898	60,353	− 5,545
Bauxite	93,208	87,823	83,956	− 3,867
Bismuth	325,015	257,397	286,516	+ 29,119
Cadmium	1,633	2,390	4,559	+ 2,169
Chromic iron ore	491,925	345,960	460,758	+ 114,798
Chromium salts	1,710	16,161	30,249	+ 14,088
Cobalt (oxide, ore, and zaffer)	74,849	17,077	11,696	− 5,381
Copper, in ore, matte, ingots, bars, manufactures, etc	46,912,347	29,664,129	38,762,957	+ 9,098,828
Iron ores	3,937,483	2,220,132	4,579,078	+ 2,358,946
Pig iron (including scrap)	5,486,109	544,600	1,657,307	+ 1,112,707
Ferrochrome	24,241	6,423	[a] 48,884	+ 42,461
Ferromanganese	5,354,656	1,860,664	3,396,381	+ 1,535,717
Ferrosilicon	1,049,283	281,590	430,169	+ 148,579
Ferrotungsten	39,417	488	93,205	+ 92,717
Spiegeleisen	1,399,381	125,054	353,447	+ 228,393
Lead, in ore, base bullion, pigs, sheets, manufactures, etc	1,082,944	516,244	861,506	+ 345,262
Manganese ores	1,793,143	1,350,223	1,405,329	+ 55,106
Nickel, in ore, matte, oxide, etc	2,243,026	2,497,585	3,036,273	+ 538,688
Platinum	2,684,642	1,229,873	2,973,948	+ 1,744,075
Quicksilver	6,719	8,216	8,203	− 13
Tin	[b] 32,074,263	[b] 23,923,560	27,558,546	+ 3,634,986
Type metal	132,027	156,847	532,108	+ 375,261
Uranium salts and oxide	8,619	7,145	12,057	+ 4,912
Zinc, in ore, pigs, sheets, dust, manufactures, etc	1,846,445	753,461	2,207,155	+ 1,453,694
Iridium, osmium, and palladium	....	....	150,863	+ 150.863
Total	8,651,418	66,682,768	89,061,400	+22,378,632
Percentage of increase (+) or decrease (−).	....	....	....	+ 33.56
EXPORTS.				
Aluminum salts	[c] 304,938	[c] 330,092	[c] 567,375	+ 237,283
Copper, in ore, matte, ingots, bars, manufactures, etc	103,252,917	91,809,675	93,919,956	+ 2,110,281
Iron ores	763,422	1,012,924	1,365,325	+ 352,401
Pig iron (including scrap)	1,908,569	1,118,926	1,399,151	+ 280,225
Lead, in ore, base bullion, pigs, sheets, manufactures, etc	686,096	599,640	509,542	− 90,098
Nickel, in ore, matte, oxide, etc	2,845,663	3,297,988	4,101,976	+ 803,988
Quicksilver	192,094	124,960	266,243	+ 141,283
Zinc, in ore, pigs, sheets, dust, manufactures, etc	1,401,831	1,683,887	1,222,173	− 461,714
Total	111,355,530	99,978,092	103,351,741	+ 3,373,649
Percentage of increase (+) or decrease (−).	....	....	....	+ 3.37

[a] Includes ferrophosphorus valued at $5,380.

[b] Including manufactures and cassiterite valued at $77,457 in 1907; at $102,381 in 1908.

[c] Aluminum and manufactures of.

Value of imports for consumption and of exports of mineral products in the calendar years 1907, 1908, and 1909—Continued.

NONMETALS.

Product.	1907.	1908.	1909.	Increase (+) or decrease (−).
IMPORTS.				
Alizarin	$782,368	$752,286	$1,191,874	+ $439,588
Aniline salts	667,758	450,891	553,503	+ 102,612
Arsenic sulphides, etc	574,998	430,400	303,728	− 126,672
Asbestos	1,304,480	1,195,870	1,233,659	+ 37,789
Asphalt	645,464	624,979	633,205	+ 8,226
Barytes	173,425	87,990	54,707	− 33,283
Barium compounds	357,117	319,114	399,376	+ 80,262
Borax	100,980	36,764	11,687	− 25,077
Burrstones and millstones	27,308	18,642	22,590	+ 3,948
Cement, hydraulic	2,614,228	1,206,832	627,116	− 579,716
Clay	337,539	189,454	290,011	+ 100,557
Clay products:				
Brick and tile, etc	225,320	147,461	189,536	+ 42,075
Pottery, etc	13,585,612	10,522,791	10,607,212	+ 84,421
Coal:				
Anthracite	40,971	73,778	12,918	− 60,860
Bituminous	5,397,222	3,964,843	3,628,533	− 336,310
Coal-tar products	7,395,035	5,840,125	8,086,099	+ 2,245,974
Coke	596,366	606,294	736,120	+ 129,826
Corundum and emery	412,630	248,399	338,997	+ 90,598
Cryolite	28,902	16,445	18,427	+ 1,982
Fertilizers	4,942,084	1,801,073	5,099,059	+ 3,297,986
Phosphates, crude	164,343	82,863	99,060	+ 16,197
Guano	400,054	92,659	772,674	+ 680,015
Flint and flint pebbles	288,371	219,754	301,547	+ 81,793
Fluorspar			26,377	+ 26,377
Fuller's earth	122,221	93,413	101,151	+ 7,738
Gems and precious stones (including pearls in 1907 and 1908)	31,866,599	13,700,404	40,237,509	+ 26,537,105
Granite	175,303	193,613	190,418	− 3,195
Graphite	1,777,389	762,367	1,854,459	+ 1,092,092
Grindstones	111,495	80,382	99,153	+ 18,771
Gypsum	535,658	354,403	425,137	+ 70,734
Hones, oilstones, whetstones	89,939	44,304	68,018	+ 23,714
Infusorial earth and rotten stone	27,121	17,252	24,024	+ 6,772
Kaolin or china clay	1,582,893	1,129,847	1,505,779	+ 375,932
Lead paints, litharge, orange mineral, red lead, white lead	115,620	88,579	101,693	+ 13,114
Lime	86,304	28,952	75,556	+ 46,604
Magnesite and magnesia	918,946	775,642	1,041,418	+ 265,776
Marble and stone	1,529,769	1,289,413	1,472,607	+ 183,194
Mica	925,259	266,058	618,813	+ 352,755
Mineral waters	1,165,555	1,033,047	1,085,177	+ 52,130
Monazite and thorium oxide			27,920	+ 27,920
Natural gas	32,107	22,003	6,060	− 15,943
Ocher	104,585	75,076	110,664	+ 35,588
Peat	46,881	45,414	47,227	+ 1,813
Petroleum	286,252	617,659	276,459	− 341,200
Ozokerite and paraffin	186,182	438,628	1,422,126	+ 983,498
Potassium salts	7,038,817	5,623,752	7,877,955	+ 2,254,203
Pumice	85,647	67,094	100,997	+ 33,903
Pyrite	2,581,787	2,624,339	2,428,580	− 195,759
Salicylic acid	1,240	1,183		− 1,183
Salt	451,282	444,690	437,827	− 6,863
Sand and gravel	94,871	77,574	106,234	+ 28,660
Sienna and umber	62,329	49,129	59,715	+ 10,586
Slate	5,404	7,227	7,872	+ 645
Sodium nitrate	[a] 14,911,196	[a] 11,424,760	[a] 13,332,548	+ 1,907,788
Strontium oxide	1,242	11	270	+ 259
Sulphur	420,175	362,379	549,632	+ 187,253
Talc	126,391	97,096	56,287	− 40,809
Throium nitrate	152,666	173,239	236,057	+ 62,818
Venetian red	37,869	25,745	28,864	+ 3,119
Zinc oxide	357,230	279,674	397,084	+ 117,410
Total	109,076,799	71,244,055	111,649,305	+ 40,405,250
Percentage of increase (+) or decrease (−)				+ 56.71
Grand total	217,728,217	137,926,823	200,710,705	+ 62,783,882
Percentage + or −				+ 45.52

[a] Including soda ash valued at $66,521 in 1907, at $38,367 in 1908, and at $50,919 in 1909.

Value of imports for consumption and of exports of mineral products in the calendar years 1907, 1908, and 1909—Continued.

NONMETALS—Continued.

Product.	1907.	1908.	1909.	Increase (+) or decrease (−).
EXPORTS.				
Asphalt	[a] $374,476	[a] $451,968	[a] $425,429	− $26,539
Cement, hydraulic	1,450,841	1,249,229	1,417,534	+ 168,305
Clay products:				
Brick and tile, etc	816,971	663,486	1,149,892	+ 486,406
Pottery, etc	1,131,641	983,760	863,695	− 120,065
Coal:				
Anthracite	13,217,985	13,524,595	14,141,468	+ 616,873
Bituminous	[b] 26,972,908	[b] 23,361,914	[b] 24,300,050	+ 938,136
Coke	3,206,793	2,161,032	3,232,673	+ 1,071,641
Fertilizers	1,641,316	1,141,666		− 1,141,666
Phosphates, crude	8,387,176	9,294,009	7,644,368	− 1,649,641
Lead paints, litharge, orange mineral, red lead, white lead	([c])	([c])		
Lime	90,379			
Marble and stone	1,088,991	1,003,251	1,170,819	+ 167,568
Ocher	([c])	([c])		
Petroleum	91,383,064	108,815,455	103,838,590	− 4,976,865
Ozokerite and paraffin	10,209,448	6,922,638	7,608,624	+ 685,986
Salt	232,895	202,338	269,273	+ 66,935
Sienna and umber	([c])	([c])		
Slate	220,995	197,216	209,383	+ 12,167
Sulphur	734,749	561,534	736,928	+ 175,394
Zinc oxide	1,069,924	845,070	1,026,377	+ 181,307
Total	162,230,552	171,379,161	168,035,103	− 3,344,058
Percentage of increase (+) or decrease (−).				− 1.95
Grand total	273,586,082	271,357,253	271,386,844	+ 29,591
Percentage + or −				+ 0.01

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[a] Asphalt and manufactures of, fiscal year.

[b] Not including bunker coal laden as fuel in vessels in the foreign trade, which aggregated in value $18,523,594 in 1907, $19,915,001 in 1908, and $19,071,314 in 1909.

[c] Not reported separately by Bureau of Statistics.

If gold and silver are included, for the sake of rounding out the metals mentioned in this report, the metallic imports increased in 1909 about 12.66 per cent, and the metallic exports increased 26.09 per cent; the total imports decreased about 26.28 per cent, and the total exports increased 14.21 per cent. The movements of gold and silver, however, are rather financial than commercial; nevertheless the following table is added to show the results mentioned above:

Value of imports for consumption and of exports of mineral products in the calendar years 1907, 1908, and 1909, including gold and silver.

Product.	1907	1908.	1909.	Increase (+) or decrease (−).
IMPORTS.				
Gold (ore, bullion, and coin)	$143,398,072	$50,276,293	$44,086,966	− $6,189,327
Silver (ore, bullion, and coin)	45,912,360	42,224,130	46,187,702	+ 3,963,572
Other metals	108,651,418	66,682,768	89,061,400	+ 22,378,632
Total	297,961,850	159,183,191	179,336,068	+ 20,152,877
Percentage + or −				+ 12.66
Total metals	297,961,850	159,183,191	179,336,068	+ 20,152,877
Total nonmetals	109,076,799	71,244,055	111,649,305	+ 40,405,250
Grand total	407,038,649	230,427,246	290,985,373	+ 60,558,127
Percentage + or −				+ 26.28

Value of imports for consumption and of exports of mineral products in the calendar years 1907, 1908, and 1909, including gold and silver—Continued.

Product.	1907.	1908.	1909.	Increase (+) or decrease (—).
EXPORTS.				
Gold (ore, bullion, and coin)	[a] $55,215,681	[a] $81,215,456	[a] $132,880,821	+$51,665,365
Silver (ore, bullion, and coin)	[b] 61,625,866	[b] 51,837,671	[b] 57,592,309	+ 5,754,638
Other metals	111,355,530	99,978,092	103,351,741	+ 3,373,649
Total	228,197,077	233,031,219	293,824,871	+ 60,793,652
Percentage + or —				+ 26.09
Total metals	228,197,077	233,031,219	293,824,871	+ 60,793,652
Total nonmetals	162,230,552	171,379,161	168,035,103	— 3,344,058
Grand total	390,427,629	404,410,380	461,859,974	+ 57,449,594
Percentage + or —				+ 14.21

[a] Including, in 1907, foreign bullion and coin valued at $1,890,256; in 1908, foreign ore valued at $5,842, and bullion and coin valued at $1,481,998; in 1909, foreign bullion and coin valued at $2,735,126.

[b] Including, in 1907, foreign ore valued at $6,213 and bullion and coin valued at $11,469,281; in 1908, foreign bullion and coin valued at $1,141,900; in 1909, foreign ore valued at $62,480 and bullion and coin valued at $1,722,596.

METALS AND METALLIC ORES IN 1908 AND 1909.

By Waldemar Lindgren.

The following tables have been prepared in order to show at a glance the quantities of metals and ores produced in the United States and their relative importance. In the separate reports the figures are given according to the units used in trade in this country, and these units are unfortunately of five kinds: Long tons, short tons, pounds, fine ounces, and ''flasks.'' In the present synopsis all have been reduced to short tons.

There is another source of confusion, due to the great development of the smelting and refining industries in the United States during the last decade. Large quantities of ore, matte, and unrefined bullion are imported, and it becomes necessary to differentiate between the metals derived from this imported material and those derived from ores taken from domestic mines.

Finally, the several stages through which a metal passes from the mining of the ore to the output of the refined product may give rise to misunderstanding. The copper production, for instance, may be measured by the quantity of blister copper, which admits of accurate distribution among States and districts, but does not give the final marketed product, or by the quantity of refined copper, in which the original output of the several mining districts can not easily be traced. Similarly lead may be stated as lead bullion or as refined lead. There is more or less discrepancy between these statements, aside from the difference due to loss in metallurgical operations, for they represent differing periods of time, during which the activity of smelters and of refineries may not have been equal. In this summary all metals are measured as refined, and the production from domestic and foreign mines is indicated in separate columns, wherever such a division is possible.

Production of metals in the United States in 1909.

[In short tons.]

Metal.	Production from domestic ores.		Production from foreign ores, matte, and unrefined bullion smelted or refined in the United States.		Total production.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Iron (pig)	27,689,883	$397,907,510	[a] 949,000	$13,637,263	28,638,883	$411,544,773
Manganese (spiegeleisen and ferromanganese)					252,045	7,630,227
Nickel			10,958	2,927,975	10,958	2,927,975
Aluminum					17,105	6,575,000
Gold	165.315	99,673,400	43.830	26,426,232	209.145	126,099,632
Silver	1,876.166	28,455,200	2,509.374	38,058,848	4,385.540	66,514,048
Platinum	.022	15,950	.017	12,490	.039	28,440
Quicksilver	790	888,710			790	888,710
Tin	22	13,094			22	13,094
Copper, stated as refined.	532,782	138,523,320	[b] 43,025 [c] 119,703	11,186,500 31,122,780	695,510	180,832,600
Lead, stated as refined	345,255	29,691,930	[d] 74,035 [e] 28,822	6,367,010 2,478,692	448,112	38,537,632
Antimonial lead					12,896	1,231,019
Zinc, stated as spelter	230,225	24,864,300	25,535	2,757,780	255,760	27,622,080
Total		720,033,414		134,975,570		870,445,230

[a] Estimated.
[b] From foreign ores and matte.
[c] From foreign blister copper.
[d] From foreign ores.
[e] From foreign base bullion.

Production of metals in the United States in 1908.

[In short tons.]

Metal.	Production from domestic ores.		Production from foreign ores, matte, and unrefined bullion smelted or refined in the United States.		Total production.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Iron (pig)	17,243,080	$242,612,854	[a] 435,000	$6,120,515	17,678,080	$248,733,369
Manganese (spiegeleisen and ferromanganese)					170,260	5,587,631
Nickel			8,293	2,396,217	8,293	2,396,217
Aluminum					5,576	2,434,600
Gold	156.835	94,560,000	44.697	26,949,168	201.532	121,509,168
Silver	1,797.970	28,050,600	2,307.424	35,668,923	4,105.394	63,719,523
Platinum	.026	14,250			.026	14,250
Quicksilver	741	824,146			741	824,146
Tin	8	4,726			8	4,726
Copper, stated as refined.	459,556	121,322,784	[b] 33,334 [c] 76,091	8,800,176 20,088,024	568,981	150,210,984
Lead, stated as refined	298,672	25,088,448	[d] 40,272 [e] 57,489	3,382,848 4,829,076	396,433	33,300,372
Antimonial lead					13,629	1,264,771
Zinc, stated as spelter	190,749	17,930,406	19,675	1,849,450	210,424	19,779,856
Total		530,408,214		110,084,397		649,779,613

[a] Estimated.
[b] From foreign ores and matte.
[c] From foreign blister copper.
[d] From foreign ores.
[e] From foreign base bullion.

NOTES.

Pig iron.—Production is usually given in long tons and includes spiegeleisen and ferromanganese. The figures are 15,936,018 long tons for 1908 and 25,795,471 long tons for 1909.

Steel-hardening metals.—Besides the manganese-iron alloys similar compounds with other metals are produced. Among them are ferrochromium, ferrotungsten (also metallic tungsten), ferrotitanium, and ferronickel. The quantities produced can not be given; the output of most of these alloys is controlled by one or two producers.

Nickel.—There is only one small producer of cobalt and nickel from domestic ores. The figures given are nickel content of ore and matte "imported for consumption." Practically all of it comes from the Canadian nickel deposits.

Cobalt.—Metallic production insignificant. The cobalt ores are utilized mainly for the manufacture of cobalt oxide.

Aluminum.—Production is stated as "consumption." There is only one producer, the Aluminum Company of America.

Gold and silver.—The production is usually given in fine ounces troy as follows:

	Year.	Domestic.	Foreign.	Total.
Gold	1908	4,574,340	1,303,666	5,878,006
	1909	4,821,701	1,278,369	6,100,070
Silver	1908	52,440,800	67,299,854	119,740,654
	1909	54,721,500	73,190,093	127,911,593

A large part of the foreign unrefined gold comes from western Canada and from Mexico and minor quantities are contained in base bullion received from other parts of the world. The foreign silver is imported in the form of unrefined bullion, mainly from Canada and Mexico.

Quicksilver.—The output is usually stated in flasks of 75 pounds; the figures are 19,752 flasks in 1908, 21,075 in 1909.

Tin.—1908 and 1909 estimate; partly smelted in England.

Copper.—Domestic output is usually stated in pounds, as blister copper; the figures are 942,570,721 pounds in 1908, 1,092,959,624 pounds in 1909. The foreign blister copper refined in the United States is imported from Europe, Canada, Mexico, Peru, Japan, and other countries.

Lead.—Usually stated in short tons. Imports of foreign ores and base bullion come mainly from Mexico.

Antimonial lead.—It is not possible to differentiate foreign from domestic production; the alloy is a metallurgical by-product, mainly in the refining of lead bullion.

Zinc.—Usually stated in short tons. Imports of foreign ores come mainly from Mexico.

The following table shows the production of crude ores from domestic mines; that is, ore supplied by the mines to concentrating plants, gold and silver mills, or smelters:

Production of crude metallic ores from domestic mines in 1908 and 1909.

[Short tons.]

	1908.	1909.
Iron ores	40,301,336	57,449,584
Manganese ores	6,881	1,729
Manganiferous iron ores	22,751	18,519
Chromium ores	402	670
Tungsten ores	4,200	13,200
Titanium ores	No production.	1,425
Aluminum ores	58,427	144,593
Gold ores	8,991,751	9,241,827
Silver ores	642,188	513,823
Quicksilver ores	Not given.	154,502
Tin ores	15	43
Copper ores:		
Western States	11,203,137	15,748,274
Central States	10,531,271	11,489,672
Eastern States	624,449	787,146
	22,358,857	28,025,092
Lead ores:		
Western States	2,391,230	2,243,840
Central States	2,690,823	3,567,847
Eastern States	800	....
	5,082,853	5,811,687
Zinc and zinc-lead ores:		
Western States	280,933	380,650
Central States	7,451,884	9,788,786
Eastern States	425,146	510,172
Total	8,157,963	10,679,608
Total	85,627,624	112,056,302

NOTES.

Iron ore.—This item includes 523,197 short tons of manganiferous iron ores in 1908 and 862,031 short tons of the same kind in 1909 shipped from Lake Superior mines. The Lake Superior and Clinton hematites are shipped without concentration. The eastern brown hematites are usually washed to remove clay. The New York magnetites, of which 1,077,603 short tons were produced in 1909, are in part concentrated in order to remove apatite and the concentrates are included in the total figure instead of the crude ore.

Manganese ore.—The small quantity of high-grade manganese ore is produced in Virginia.

Manganiferous iron ore.—The low-grade manganiferous iron ore from Lake Superior region is included in the iron ores. The remaining manganiferous iron ores come mainly from Colorado and Arkansas, and are chiefly used for the manufacture of spiegeleisen. A large tonnage of silver-bearing manganese ore from Leadville used for flux in lead smelting is included under the ores of the precious metals.

Chromium ore.—Used for the manufacture of chromium salts and ferrochromium. Imports of chromium ore were 44,379 short tons in 1909.

Tungsten ores.—Tonnage of crude ore estimated. From the crude ore 671 tons of concentrates were obtained in 1908 and 1,619 tons in 1909.

Vanadium ores.—Tonnage small, not ascertained.

Titanium ores.—Mostly rutile ore from Virginia; used for manufacture of ferrotitanium and other titanium compounds.

Aluminum ores.—The figures give the bauxite ore as shipped. The crude ore is washed to remove clay. As bauxite is used for many purposes, the output stands in no direct relation to the production of aluminum. Imports of bauxite in 1909 were 20,831 short tons.

Gold ores.—The figures include siliceous gold ores and other classes containing predominant gold values. The domestic gold production is not in direct relation to this tonnage, for the quantity of gravel handled in placer mining is not included in the figures. A large part of the total gold output is also derived from copper and lead ores. Exact figures for the amount of gravel washed are not available, but the volume may be estimated at 80,000,000 cubic yards, with an average value of 12 cents per cubic yard, for the United States in 1909, and about 4,418,000 cubic yards for Alaska, with an average value of $3.66 per cubic yard.

Silver ores.—These include mainly silver-gold ores, in which the value of the silver exceeds that of the gold. The bulk comes from Tonopah, Nev. Included are also iron-manganese-silver ores of Leadville used for flux in lead smelters. The latter are poor in silver. Of these, 111,764 tons were mined in 1908 and 91,960 tons in 1909. Pure silver ores mined for this metal alone probably do not amount to more than 2,000 tons per annum.

The production of silver does not stand in direct relation to the tonnage of silver ores, because about two-thirds of the total output is obtained as a by-product of lead and copper ores.

Quicksilver ores.—The tonnage of quicksilver ores was not ascertained previously to 1909.

Tin ores.—Stated as concentrates, mainly from placer operations.

Copper ores.—The copper ores of the Western States are in part concentrated, in part smelted crude. The copper ores of Michigan are always concentrated. The ores of the Eastern States, which are mined mainly in Tennessee, are smelted crude. The total quantity of copper concentrates produced in 1908 was 1,456,372 short tons, and in 1909, 2,329,860 short tons. A little copper is also derived from the gold, lead, and zinc ores.

Lead ores.—The lead ores of the Western and Central States are generally concentrated. In 1908 the lead concentrates from the Central States, mainly from Missouri, amounted to 230,220 tons; in 1909 to 260,640 tons. The State of Idaho, which is the principal producer of lead concentrate in the Western States, yielded 183,459 tons in 1908 and 188,754 tons in 1909.

Zinc ores.—A considerable part of the zinc ores is used for the manufacture of paint, so that the quantity of ore bears no direct relation to that of metal. Except some western ores, which are shipped crude, zinc ores are generally concentrated, the principal production from the Western States coming from Leadville, Colo.

Full statistics for concentrates are not available from the Western States, but the approximate quantity of zinc concentrates may be seen from the following table:

Production of zinc concentrates in 1908 and 1909.

[Short tons.]

	1908.	1909.
Leadville	43,557	38,056
Central States	317,291	374,929
Eastern States	258,134	302,315
	618,982	715,300

IRON ORE, PIG IRON, AND STEEL.

By Ernest F. Burchard.

INTRODUCTION.

The iron and steel industry of the United States, after having experienced a deep depression in 1908, practically recovered during 1909 the position it formerly held, but made no gains over the total business of 1907. The slow recovery of activity characteristic of the last part of 1908 continued during the early months of 1909, but at first with much uncertainty. The curve showing pig-iron production by months for the years 1907, 1908, and 1909 (see fig. 2) affords a graphic outline of the general condition of the industry in these years. From April to October, 1909, there was a steady and rapid increase in the output of pig iron, with a slight lull in November, followed by a record-breaking production in December, which averaged 86,500 tons a day, as compared with 55,600 tons a day in December, 1908. On December 31, 1909, there were 338 furnaces in blast out of a total of 469; on the same date in 1908 there were 236 furnaces in blast out of a total of 459.

As a consequence of the recovery of normal conditions in 1909 the iron-ore output was brought up to nearly the total for 1907. The total quantity of iron ore produced in 1909, not including stocks left at mines, was 51,294,271 long tons, as compared with 35,983,336 tons in 1908 and with 51,720,619 tons in 1907; the output of pig iron in 1909 was 25,795,471 long tons, as compared with 15,936,018 tons in 1908 and with 25,781,361 tons in 1907. The total production of all kinds of steel ingots and castings in 1909 amounted to 23,955,021 long tons, as compared with 14,023,247 long tons in 1908 and with 23,362,594 tons in 1907.

In 1908 an agreement among iron and steel makers to refrain from destructive competition maintained fairly steady though not high prices for their products, notwithstanding the light demand. Prices during the last half of 1908 were generally lower than during the first half of the year. In February, 1909, an open market was declared by iron and steel manufacturers on finished products except rails, and as a result prices sagged to comparatively low levels, reaching the minimum in April and May. The last half of the year showed a steady recovery in prices to points at or slightly above those prevailing at the end of 1908 for most finished steel products, except wire nails, and to points $1 to $2.50 higher for pig iron.

The increase in the production of iron ore in 1909 over that of 1908 was more than 42 per cent, and the increase in the production of pig iron and steel was about 62 per cent and 70 per cent, respectively.

The accompanying figure shows the production of iron ore, pig iron, and steel since 1870, and illustrates well the great decrease which followed the financial panic of October, 1907.

The statistics of production of iron ore for 1909 were collected by the United States Geological Survey in cooperation with the Bureau of the Census, and the compilation of the replies to the numerous and detailed inquiries contained in the general census schedule has delayed the statistics far beyond the time at which the Geological Survey usually presents them to the public. Cordial thanks are due the various mine owners and operators for the promptness and courtesy with which they have replied to the various requests of the Survey for information.

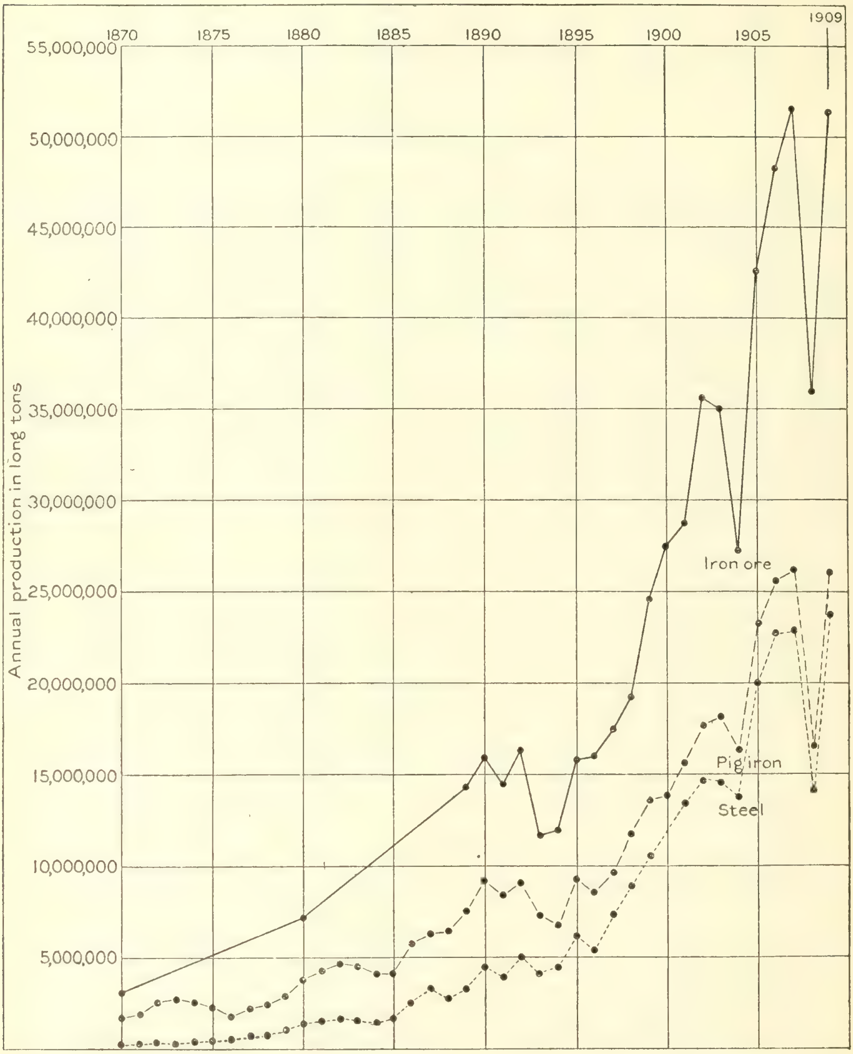

FIGURE 1.—Curve showing the production of iron ore, pig iron, and steel in the United States, 1870–1909, in long tons.

IRON-ORE INDUSTRY OF THE UNITED STATES.

PRODUCTION OF IRON ORE BY COMMERCIAL DISTRICTS.

The iron ore produced in the United States in 1909 amounted to 51,294,271 long tons, valued at $110,290,596 at the mines, as compared with 35,983,336 long tons, valued at $81,845,904, produced in 1908. This represents an increase of 42.5 per cent in tonnage and of 34.7 per cent in value. Notwithstanding this large increase, the production of iron ore in 1909 did not quite reach the high record made in 1907.

Iron ore was mined in 26 States during 1909. Of these, four States—Montana, Nevada, New Mexico, and Wyoming—produced ores for fluxing purposes only; the rest produced ores for blast furnace use.

The various States in which iron ore occurs may be conveniently grouped into six commercial districts, namely:

1. *Northeastern district:* Including Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, and Ohio.
2. *Southeastern district:* Including Maryland, the Virginias, Kentucky, Tennessee, North Carolina, Georgia, and Alabama.
3. *Lake Superior district:* Including Michigan, Wisconsin, and Minnesota.
4. *Mississippi Valley district:* Including Iowa, Missouri, Arkansas, and Texas.
5. *Rocky Mountain district:* Including Montana, Wyoming, Colorado, New Mexico, Utah, and Nevada.
6. *Pacific Slope district:* Including Washington and California.

Each of these districts may be subdivided into mining districts and the ores classified with regard to variety and to distribution of deposits. These subdivisions are discussed in another section. The Lake Superior is by far the most important of these districts and is followed in order by the southeastern district and the northeastern district; the Mississippi Valley and the western districts are of minor importance. The following table shows the relative output of iron ore in each of the commercial districts during 1907, 1908, and 1909:

Production of iron ore in the United States, by commercial districts, in 1907, 1908, and 1909, in long tons.

District.	1907.		1908.		1909.	
	Quantity.	Percentage of total.	Quantity.	Percentage of total.	Quantity.	Percentage of total.
Northeastern	2,822,822	5.46	1,590,098	4.42	2,280,741	4.45
Southeastern	6,197,360	11.98	5,484,821	15.24	6,197,717	12.08
Lake Superior	41,638,744	80.51	28,225,412	78.44	41,942,969	81.77
Mississippi Valley	230,435	.44	154,380	.43	96,428	.19
Rocky Mountain	[1] 831,258	1.61	[1] 528,625	1.47	[1] 776,416	1.51
Pacific Slope	(a)	....	(a)	....	(a)	....
	51,720,619	100.00	35,983,336	100.00	51,294,271	100.00

[a] Pacific slope included in Rocky Mountain district.

PRODUCTION OF IRON ORE, BY STATES.

The following table gives a comparison of the iron-ore production, by States, for 1908 and 1909, showing increase and decrease and the percentage of increase and decrease in the several States.

Quantity and value of iron ore produced in the United States, 1908 and 1909, by States.

State.	1908.		1909.		Increase (+) or decrease (−) in 1909.		Percentage of increase (+) or decrease (−) in 1909.	
	Quantity, in long tons.	Value.	Quantity, in long tons.	Value.	Quantity, in long tons.	Value.	Quantity, in long tons.	Value.
Alabama	3,734,438	$4,358,902	4,321,252	$4,996,455	+ 586,814	+ $637,553	+15.71	+14.63
Colorado	10,176	18,432	10,000	16,000	− 176	− 2,432	− 1.73	−13.19
Connecticut and Massachusetts	28,112	105,457	38,272	141,274	+ 10,160	+ 35,817	+36.14	+33.96
Georgia	321,060	540,189	221,016	332,478	− 100,044	− 207,711	−31.16	−38.45
Kentucky, Maryland, and West Virginia	53,235	84,898	98,657	157,073	+ 45,422	+ 72,175	+85.32	+85.01
Michigan	8,839,199	25,150,861	11,900,384	32,282,622	+ 3,061,185	+ 7,131,761	+34.63	+28.36
Minnesota	18,652,220	42,313,974	28,975,149	60,253,314	+10,322,929	+17,939,340	+55.34	+42.40
Missouri	98,414	218,182	89,954	210,853	− 8,460	− 7,329	− 8.60	− 3.36
Montana, Nevada, New Mexico, Utah, Washington, and Wyoming	518,449	708,760	766,416	955,775	+ 247,967	+ 247,015	+47.83	+34.85
New Jersey	394,767	1,162,474	543,720	1,607,003	+ 148,953	+ 444,529	+37.73	+38.24
New York	697,473	2,098,247	1,015,333	3,072,323	+ 317,860	+ 974,076	+45.57	+46.42
North Carolina	48,522	76,877	61,150	107,013	+ 12,628	+ 30,136	+26.03	+39.20
Ohio	26,585	36,736	16,527	28,547	− 10,058	− 8,189	−37.83	−22.29
Pennsylvania	443,161	572,346	666,889	792,672	+ 223,728	+ 220,326	+50.48	+38.50
Tennessee	635,343	876,007	657,795	907,282	+ 22,452	+ 31,275	+ 3.53	+ 3.57
Texas	55,966	30,663	6,474	9,318	− 49,492	− 21,345	−88.43	−69.61
Virginia	692,223	1,465,691	837,847	1,693,188	+ 145,624	+ 227,497	+21.04	+15.52
Wisconsin	733,993	2,027,208	1,067,436	2,727,406	+ 333,443	+ 700,198	+45.43	+34.54
Total	35,983,336	81,845,904	51,294,271	110,290,596	+15,310,935	+28,444,692	+42.55	+34.75

In the following table the States are arranged according to their rank as producers in 1908 and 1909, with regard both to the quantity and the value of the iron ore produced:

Rank of iron ore producing States in 1908, and 1909, with quantity and value of product and percentage of each.

1908.

Production.				Value.			
Rank.	State.	Quantity, in long tons.	Percentage of total production.	Rank.	State.	Amount.	Percentage of total value.
1	Minnesota	18,652,220	51.84	1	Minnesota	$42,313,974	51.70
2	Michigan	8,839,199	24.56	2	Michigan	25,150,861	30.73
3	Alabama	3,734,438	10.38	3	Alabama	4,358,902	5.33
4	Wisconsin	733,993	2.04	4	New York	2,098,247	2.56
5	New York	697,473	1.94	5	Wisconsin	2,027,208	2.48
6	Virginia	692,223	1.92	6	Virginia	1,465,691	1.79
7	Tennessee	635,343	1.77	7	New Jersey	1,162,474	1.42
8	Montana, Nevada, New Mexico, Utah, Washington, and Wyoming	518,449	1.44	8	Tennessee	876,007	1.07
9	Pennsylvania	443,161	1.23	9	Montana, Nevada, New Mexico, Utah, Washington, and Wyoming	708,760	.87
10	New Jersey	394,767	1.10	10	Pennsylvania	572,346	.70
11	Georgia	321,060	.89	11	Georgia	540,189	.66
12	Missouri	98,414	.27	12	Missouri	218,182	.27
13	Texas	55,966	.16	13	Connecticut and Massachusetts	105,457	.13
14	Kentucky, Maryland, and West Virginia	53,235	.15	14	Kentucky, Maryland, and West Virginia	84,898	.10
15	North Carolina	48,522	.13	15	North Carolina	76,877	.09
16	Connecticut and Massachusetts	28,112	.08	16	Ohio	36,736	.04
17	Ohio	26,585	.07	17	Texas	30,663	.04
18	Colorado	10,176	.03	18	Colorado	18,432	.02
	Total	35,983,336	100.00		Total	81,845,904	100.00

Rank of iron ore producing States in 1908, and 1909, with quantity and value of product and percentage of each—Continued.

1909.

Production.				Value.			
Rank.	State.	Quantity, in long tons.	Percentage of total production.	Rank.	State.	Amount.	Percentage of total value.
1	Minnesota	28,975,149	56.49	1	Minnesota	$60,253,314	54.63
2	Michigan	11,900,384	23.20	2	Michigan	32,282,622	29.27
3	Alabama	4,321,252	8.43	3	Alabama	4,996,455	4.53
4	Wisconsin	1,067,436	2.08	4	New York	3,072,323	2.79
5	New York	1,015,333	1.98	5	Wisconsin	2,727,406	2.47
6	Virginia	837,847	1.63	6	Virginia	1,693,188	1.54
7	Montana, Nevada, New Mexico, Utah, Washington, and Wyoming	766,416	1.50	7	New Jersey	1,607,003	1.46
8	Pennsylvania	666,889	1.30	8	Montana, Nevada, New Mexico, Utah, Washington, and Wyoming	955,775	.87
9	Tennessee	657,795	1.28	9	Tennessee	907,282	.82
10	New Jersey	543,720	1.06	10	Pennsylvania	792,672	.72
11	Georgia	221,016	.43	11	Georgia	332,478	.30
12	Kentucky, Maryland, and West Virginia	98,657	.19	12	Missouri	210,853	.19
13	Missouri	89,954	.18	13	Kentucky, Maryland, and West Virginia	157,073	.14
14	North Carolina	61,150	.12	14	Connecticut and Massachusetts	141,274	.13
15	Connecticut and Massachusetts	38,272	.07	15	North Carolina	107,013	.10
16	Ohio	16,527	.03	16	Ohio	28,547	.02
17	Colorado	10,000	.02	17	Colorado	16,000	.01
18	Texas	6,474	.01	18	Texas	9,318	.01
	Total	51,294,271	100.00		Total	110,290,596	100.00

PRODUCTION OF IRON ORE BY VARIETIES, BY STATES AND MINING DISTRICTS.

Iron minerals are classified as sulphides, oxides, carbonates, silicates, etc., of which only the oxides and carbonates are used in the steel industry. The ores of iron are generally classed under four heads:

1. *Hematite:* Including all the anhydrous sesquioxides (Fe_2O_3—theoretical percentage of iron, 70). This is known locally as red hematite, specular ore, gray ore, fossil ore, oolitic ore, etc.
2. *Brown ore:* Including hydrated sesquioxides, such as limonite, göthite, and turgite ($Fe_2O_3nH_2O$—theoretical percentage of iron, 59.8–66). This is known locally as brown iron ore, brown hematite, bog ore, limonite, etc.
3. *Magnetite:* Including magnetic oxides (Fe_3O_4—theoretical percentage of iron, 72.4). Magnetite is known generally as magnetic iron ore.
4. *Iron carbonate:* Including carbonates of various types ($FeCO_3$—theoretical percentage of iron, 48.2). Iron carbonate is known locally as spathic iron ore, kidney ore, black band ore, siderite, etc.

Hematite has always been predominant as an ore of iron, and at present constitutes almost nine-tenths of the iron ores produced. Brown ore and magnetite are far below it in importance, each furnishing at present about one-twentieth of the total iron-ore production. The production of iron carbonate is insignificant in comparison with that of the other ores, constituting only about one-thirtieth of 1 per cent of the total.

In the following table are shown the quantities of each of the classes of iron ores produced in the various States during 1908 and 1909:

Production of iron ore in the United States in 1908 and 1909, by States and varieties, in long tons.

1908.

State.	Hematite.	Brown ore.	Magnetite.	Carbonate.	Total quantity.
Alabama	2,775,903	958,535			3,734,438
Colorado		10,176			10,176
Connecticut and Massachusetts		28,112			28,112
Georgia	1,248	319,812			321,060
Kentucky, Maryland, and West Virginia	7,491	45,744			53,235
Michigan	8,839,199				8,839,199
Minnesota	18,652,220				18,652,220
Missouri	77,400	21,014			98,414
Montana, Nevada, New Mexico, Utah, Washington, and Wyoming	354,012	68,565	95,872		518,449
New Jersey		([a])	[a] 394,767		394,767
New York	33,825		663,648		697,473
North Carolina			48,522		48,522
Ohio				26,585	26,585
Pennsylvania	26,162	73,001	343,998		443,161
Tennessee	226,038	409,305			635,343
Texas		55,966			55,966
Virginia	64,323	626,910	990		692,223
Wisconsin	730,743	3,250			733,993
Total	31,788,564	2,620,390	1,547,797	26,585	35,983,336

1909.

State.	Hematite.	Brown ore.	Magnetite.	Carbonate.	Total quantity.
Alabama	3,176,416	1,144,836			4,321,252
Colorado		10,000			10,000
Connecticut and Massachusetts		38,272			38,272
Georgia	9,521	211,495			221,016
Kentucky, Maryland, and West Virginia	45,000	53,657			98,657
Michigan	11,900,384				11,900,384
Minnesota	28,975,149				28,975,149
Missouri	67,391	22,563			89,954
Montana, Nevada, New Mexico, Utah, Washington, and Wyoming	542,744	143,834	79,838		766,416
New Jersey		([a])	[a] 543,720		543,720
New York	53,187		962,146		1,015,333
North Carolina			61,150		61,150
Ohio				16,527	16,527
Pennsylvania	5,144	80,715	581,030		666,889
Tennessee	298,818	358,977			657,795
Texas		6,474			6,474
Virginia	72,955	762,937	1,955		837,847
Wisconsin	1,061,931	5,505			1,067,436
Total	46,208,640	2,839,265	2,229,839	16,527	51,294,271

[a] Brown ore is included in magnetite.

From this table it will be seen that the great bulk of the hematite comes from the Lake Superior district (Michigan, Minnesota, and Wisconsin) and Alabama, the brown ore from the Appalachian States, and the magnetite from New York, New Jersey, and Pennsylvania. All the iron carbonate is obtained from Ohio. On a later page is given the production of the principal ranges in the Lake Superior district. In this report the production is given for the first time of two important southern mining centers, the Birmingham and the Chattanooga districts. In the Birmingham district are included, besides the mines in the immediate vicinity of Birmingham, those in eastern Alabama that ship ores to the furnaces at Birmingham. In the Chattanooga district are included those mines that ship ores to Chattanooga, Tenn., to Rome, Ga., and to Gadsden and Attalla, Ala. The mines near Russellville, Ala., are not included in either district.

Production of iron ore in the United States, by mining districts and varieties, in 1909, in long tons.

District.	Hematite.	Brown ore.	Magnetite.	Carbonate.	Total.
Lake Superior	41,863,635				41,863,635
Birmingham	2,955,246	508,843			3,464,089
Chattanooga	465,494	487,988			953,482
Adirondack	(a)		a 869,185		869,185
Northern New Jersey and southeastern New York		(b)	b 634,069		634,069
Other	914,001	1,842,434	736,849	16,527	3,509,811
Total	46,198,376	2,839,265	2,240,103	16,527	51,294,271

a Hematite is included in magnetite. b Brown ore is included in magnetite.

TOTAL PRODUCTION OF IRON ORE.

In the following table is shown the production of the various types of iron ores in the United States as far as has been recorded. The statistics from 1889 to the present were collected by the United States Geological Survey; those for 1860, 1870, and 1880 were collected for the census reports of those years; those for 1875 and 1881 were estimated by I. L. Bell;[a] and those from 1882 to 1888, inclusive, were estimated by James M. Swank[b] from the pig-iron production. No figures can be obtained for the production of various classes of iron ores prior to 1889, except for the census year 1880.

Production of iron ore in the United States, 1860–1909, in long tons.

Year.	Hematite.	Brown ore.	Magnetite.	Carbonate.	Total.
1860					2,873,460
1870					c 3,831,891
1875					4,017,857
1880	2,243,993	1,918,622	2,134,276	823,471	7,120,362
1881					7,119,643
1882					d 8,700,000
1883					d 8,800,000
1884					d 7,718,129
1885					d 7,600,000
1886					d 10,000,000
1887					d 11,300,000
1888					d 12,062,530
1889	9,056,288	2,523,087	2,506,415	432,251	14,518,041
1890	10,527,650	2,559,938	2,570,838	377,617	16,036,043
1891	9,327,398	2,757,564	2,317,108	189,108	14,591,178
1892	11,646,619	2,485,101	1,971,965	192,981	16,296,666
1893	8,272,637	1,849,272	1,330,886	134,834	11,587,629
1894	9,347,434	1,472,748	972,219	87,278	11,879,679
1895	12,513,995	2,102,358	1,268,222	73,039	15,957,614
1896	12,576,288	2,126,212	1,211,526	91,423	16,005,449
1897	14,413,318	1,961,954	1,059,479	83,295	17,518,046
1898	16,150,684	1,989,681	1,237,978	55,373	19,433,716
1899	20,004,399	2,869,785	1,727,430	81,559	24,683,173
1900	22,708,274	3,231,089	1,537,551	76,247	27,553,161
1901	24,006,025	3,016,715	1,813,076	51,663	28,887,479
1902	30,532,149	3,305,484	1,688,860	27,642	35,554,135
1903	30,328,654	3,080,399	1,575,422	34,833	35,019,308
1904	23,839,477	2,146,795	1,638,846	19,212	27,644,330
1905	37,567,055	2,546,662	2,390,417	21,999	42,526,133
1906	42,481,375	2,781,063	2,469,294	17,996	47,749,728
1907	46,060,486	2,957,477	2,679,067	23,589	51,720,619
1908	31,788,564	2,620,390	1,547,797	26,585	35,983,336
1909	46,208,640	2,839,265	2,229,839	16,527	51,294,271

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[a] Bell, I. L., Principles of the manufacture of iron and steel, 1884, p. 451.

[b] Mineral Resources U. S., 1882 to 1888.

[c] Includes ore produced by owners of blast furnaces estimated by census at 800,000 tons.

[d] Figures given are for consumption of domestic ores. Total production for 1882, 1883, and 1884 is estimated as 9,000,000, 8,400,000, and 8,200,000 tons, respectively. See Mineral Resources U. S. for 1883 and 1884.

In the following table the production of iron ores in the United States is shown from 1810 to 1869, and by decades from 1870 to 1909. The figures for the years previous to 1889 were calculated from the pig-iron production and include imported ore as well as domestic ore used.

Production of iron ore in the United States from 1810 to 1909, by decades, and rate of increase.

Decade.	Quantity, in long tons.	Percentage of increase.
1810-1869	49,656,000	....
1870-1879	43,770,527	....
1880-1889	91,043,854	108.0
1890-1899	163,989,193	80.1
1900-1909	383,932,500	134.1

STOCKS OF IRON ORE AT MINES.

Considerable stock was left at the mines at the end of 1909 which is not included in the production. On December 31, 1909, this stock amounted to 6,135,271 tons, as compared with 6,065,397 tons on December 31, 1908. Besides the stock at the mines, stocks are left at receiving ports, but these are included in the annual production.

The following table shows the tonnage of stock left at the mines on December 31, 1908 and 1909, in the various States:

Stock of iron ore on hand at the mines December 31, 1908 and 1909, by States, in long tons.

State.	1908.	1909.
Alabama	381,607	717,153
California	....	97
Colorado	400	700
Georgia	50,550	46,385
Kentucky	600	400
Maryland	....	29
Massachusetts	952	711
Michigan	3,280,659	3,186,211
Minnesota	1,737,568	1,678,540
Missouri	10,546	250
New Jersey	115,218	113,773
New York	118,415	247,286
Ohio	15,041	9,802
Pennsylvania	15,781	4,400
Tennessee	26,923	20,357
Texas	53,600	....
Utah	....	100
Vermont	350	....
Virginia	8,823	1,000
Washington	15,000	1,000
Wisconsin	233,364	107,077
Total	6,065,397	6,135,271
Percentage of increase in 1909	....	1.15

PRICE OF IRON ORE PER TON.

In the following table the price per ton of the different classes of iron ores in 1909 is given for each of the producing States. In 1909 the average values were very nearly the same as those of 1908, with the exception of that for the carbonate ore. The total average values per long ton in 1909 were: Hematite, $2.17; brown ore, $1.71; magnetite, $2.40; carbonate, $1.73, as compared with values, respectively, of $2.32, $1.70, $2.40, and $1.38 in 1908. These figures represent the value at the mines and are taken directly from statements of the producers. They should be accepted merely as fair approximation to the truth. The element of inaccuracy arises from the fact that by far the greater bulk of the iron ore produced in the United States is mined by pig-iron producers for their own furnaces, and the value placed on such ore is therefore entirely a matter of accounting. Some of the reports made to the Survey evidently include merely actual mining costs; others contain an allowance for sinking fund; and in still others the figures given are merely convenient prices to use in charging costs against the blast furnaces.

It is to be noted, however, that the errors are almost entirely in one direction—that of undervaluing the ore rather than of overvaluing it. If all the iron ore were to be bought by iron furnaces in open market from an entirely distinct set of iron-ore producers, the average prices paid would probably be considerably in excess of those now reported. It is of interest to compare the prices given below with those of the Lake Superior ores at the lower Lake ports given in a subsequent table.

Average price per long ton of iron ore in the United States in 1909, by States and varieties.

State.	Hematite.	Brown ore.	Magnetite.	Carbonate.
Alabama	$1.07	$1.41		
Colorado		1.60		
Connecticut and Massachusetts		3.69		
Georgia	1.69	1.50		
Kentucky, Maryland, and West Virginia	1.25	1.88		
Michigan	2.71			
Minnesota	2.08			
Missouri	2.49	1.92		
Montana, Nevada, New Mexico, Utah, Washington, and Wyoming	1.00	2.32	$1.00	
New Jersey		2.53	2.96	
New York	1.88		3.09	
North Carolina			1.75	
Ohio				$1.73
Pennsylvania	2.36	2.41	1.01	
Tennessee	1.30	1.45		
Texas		1.44		
Virginia	1.76	2.05	2.00	
Wisconsin	2.56	1.62		
Total average	2.17	1.71	2.40	1.73

APPARENT ANNUAL IRON-ORE CONSUMPTION.

The following table includes data on certain factors from which an approximate estimate of the annual consumption of iron ore in the United States is deduced. The result is of course merely an approximation, for no data are available on certain other factors which should enter into the final result. The elements accounted for in the table and estimate are (1) domestic iron-ore production; (2) stocks of ore at mines for current year and past year; (3) stocks of ore at Lake ports for current year and past year; (4) zinc residuum production; (5) imports of ore; (6) exports of ore.

Apparent consumption of iron ore in the United States, 1889–1909, in long tons.

Year.	Domestic iron ore produced.	Stocks of ore at mines.	Stocks of ore at lower Lake ports Dec. 1.	Zinc residuum.	Imports.	Exports.	Apparent consumption.
1889	14,518,041	2,256,973	2,607,106	43,648	853,573	....	14,366,562
1890	16,036,043	2,000,000	3,893,487	48,560	1,246,830	....	16,302,025
1891	14,591,178	2,450,279	3,508,489	38,228	912,864	....	15,476,989
1892	16,296,666	2,911,740	4,149,451	31,859	806,585	....	16,032,687
1893	11,587,629	3,526,161	4,070,710	37,512	526,951	....	11,616,412
1894	11,879,679	3,236,198	4,834,247	26,981	167,307	....	11,600,393
1895	15,957,614	2,976,494	4,415,712	43,249	524,153	....	17,203,255
1896	16,005,449	3,405,302	4,954,984	44,953	682,806	....	15,765,128
1897	17,518,046	3,098,287	5,923,755	33,924	489,970	....	17,380,184
1898	19,433,716	2,846,457	5,136,407	48,502	187,208	....	20,708,604
1899	24,683,173	2,320,278	5,530,283	65,010	674,082	40,665	25,513,903
1900	27,553,161	3,709,950	5,904,670	87,110	897,831	51,460	26,722,583
1901	28,887,479	4,239,823	5,859,663	52,311	966,950	64,703	29,357,171
1902	35,554,135	3,834,717	7,074,254	65,246	1,165,470	88,445	35,886,921
1903	35,019,308	6,297,888	6,371,085	73,264	980,440	80,611	34,232,399
1904	27,644,330	4,666,931	5,763,399	68,189	487,613	213,865	30,224,910
1905	42,526,133	3,812,281	6,438,967	90,289	845,651	208,017	43,433,138
1906	47,749,728	3,281,789	6,252,455	93,461	1,060,390	265,240	49,355,343
1907	51,720,619	3,033,110	7,385,728	93,413	1,229,168	278,208	51,880,398
1908	35,983,336	6,065,397	8,441,533	110,225	776,898	309,099	32,473,268
1909	51,294,271	6,135,271	8,965,789	141,264	1,696,411	455,934	52,081,882

COMPARATIVE PRODUCTION OF IRON ORE AND PIG IRON.

Detailed data on the pig-iron production of the United States are presented on later pages of this report, but in the following table an interesting comparison is made between the annual production of iron ore and of pig iron.

Production of iron ore and pig iron in the United States, 1889–1909, in long tons.

Year.	Iron ore mined.	Pig iron produced.[a]	Year.	Iron ore mined.	Pig iron produced.[a]
1889	14,518,041	7,603,642	1900	27,553,161	13,789,242
1890	16,036,043	9,202,703	1901	28,887,479	15,878,354
1891	14,591,178	8,279,870	1902	35,554,135	17,821,307
1892	16,296,666	9,157,000	1903	35,019,308	18,009,252
1893	11,587,629	7,124,502	1904	27,644,330	16,497,033
1894	11,879,679	6,657,388	1905	42,526,133	22,992,380
1895	15,957,614	9,446,308	1906	47,749,728	25,307,191
1896	16,005,449	8,623,127	1907	51,720,619	25,781,361
1897	17,518,046	9,652,680	1908	35,983,336	15,936,018
1898	19,433,716	11,773,934	1909	51,294,271	25,795,471
1899	24,683,173	13,620,703			

[a] From annual reports of the American Iron and Steel Association.

IRON-ORE INDUSTRY IN THE LAKE SUPERIOR DISTRICT.

Production of iron ore in the Lake Superior district, by ranges.—The Lake Superior district includes the Vermilion, Mesabi, Cuyuna, Penokee-Gogebic, Marquette, and Menominee ranges in the States of Minnesota, Michigan, and Wisconsin. The Menominee range includes the Crystal Falls, Metropolitan, Iron River, and Florence areas; the Marquette range includes the Republic and Swanzy areas. The Baraboo and Iron Ridge areas of southern Wisconsin and the Spring Valley area of northwestern Wisconsin are frequently also included in the Lake Superior district. In the first group of ranges the ore mined is almost entirely pre-Cambrian hematite associated with the Lake Superior iron-ore formation. The Baraboo ore is of the same nature, but the Iron Ridge ore is Clinton hematite, and the Spring Valley ore is brown ore.

In addition to these ranges, there are several iron-ore districts on the Canadian side of the Great Lakes, the principal ones of which are the Michipicoten, the Animikie, the Matawin, and the Atikokan.

The American districts which produced ore in 1909 were the Vermilion, Mesabi, Penokee-Gogebic, Marquette, Menominee, Baraboo, and Spring Valley. The following table shows the production of the first five of these for 1908 and 1909, as they constitute the Lake Superior district proper:

Production of iron ore in the Lake Superior region, 1908–9, by ranges.

Range.	1908.	1909.	Increase in 1909.	Percentage of increase in 1909.	Percentage of total production in Lake Superior region.
	Long tons.	*Long tons.*	*Long tons.*		
Marquette (Michigan)	3,309,917	[a] 4,291,967	982,050	29.66	10.25
Menominee (Michigan and Wisconsin)	2,904,011	4,789,362	1,885.351	64.92	11.44
Gogebic (Michigan and Wisconsin)	3,241,931	[a] 3,807,157	565,226	17.43	9.10
Vermilion (Minnesota)	927,206	1,097,444	170,238	18.36	2.62
Mesabi (Minnesota)	17,725,014	27,877,705	10,152,691	57.28	66.59
Total	28,108,079	41,863,635	13,755,556	48.94	100.00

[a] Some Gogebic ore included in Marquette.

The Mesabi range produced 66.59 per cent of the entire Lake Superior output and about 54.3 of the entire production of the United States. The Menominee, Marquette, and Penokee-Gogebic ranges are next in importance, the Menominee producing a little more and the others a little less than the State of Alabama, which is the next State in importance as a producer after Minnesota and Michigan. The Vermilion range, the last in importance of the five producing Lake Superior ranges, produced more ore than New York, which is fifth in importance as a producing State.

In the following table is shown the total production of the Lake Superior district by ranges. The figures prior to 1872 were collected by A. P. Swineford, editor Marquette Mining Journal;[a] those for 1872 to 1877, inclusive, are from the Michigan Mineral Statistics; those from 1878 to 1888, inclusive, were collected by W. J. Stevens;[b] and the later figures were collected by the United States Geological Survey.

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[a] Mineral Resources U. S. for 1882, p. 116.
[b] Mineral Resources U. S. for 1891, p. 41.

Production of Lake Superior iron ore, 1854–1909, by ranges, in long tons.

Year.	Marquette.	Menominee.	Gogebic.	Vermillion.	Mesabi.	Total.
1854–1869	3,112,209					3,112,209
1870	859,507					859,507
1871	813,984					813,984
1872	918,553					948.553
1873	1,195,234					1,195,234
1874	899,934					899,934
1875	881,166					881,166
1876	993,311					993,311
1877	1,014,754	10,375				1,025,129
1878	1,033,082	78,028				1,111,110
1879	1,130,019	245,672				1,375,691
1880	1,384,010	524,735				1,908,745
1881	1,579,834	726,671				2,306,505
1882	1,829,394	1,136,018				2,965,412
1883	1,305,364	1,047,863				2,353,227
1884	1,559,912	895,634	1,022	62,122		2,518,690
1885	1,430,862	690,435	119,590	227,075		2,467,962
1886	1,627,383	880,006	756,237	307,948		3,571,574
1887	1,851,717	1,199,343	1,285,265	394,910		4,731,235
1888	1,918,672	1,191,097	1,433,689	511,953		5,055,411
1889	2,631,026	1,876,157	2,147,923	864,508		7,519,614
1890	2,863,848	2,274,192	2,914,081	891,910		8,944,031
1891	2,778,482	1,856,124	2,041,754	945,105		7,621,465
1892	2,848,552	2,402,195	3,058,176	1,226,220	29,245	9,564,388
1893	2,064,827	1,563,049	1,466,815	815,735	684,194	6,594,620
1894	1,935,379	1,255,255	1,523.451	1,055,229	1,913,234	7,682,548
1895	1,982,080	1,794,970	2,625,475	1,027,103	2,839,350	10,268,978
1896	2,418,846	1,763,235	2,100,398	1,200,907	3,082,973	10,566,359
1897	2,673,785	1,767,220	2,163,088	1,381,278	4,220.151	12,205,522
1898	2,987,930	2,275,664	2,552,205	1,125,538	4,837,971	13,779,308
1899	3,634,596	3,281,422	2,725,648	1,643,984	6,517,305	17,802,955
1900	3,945,068	3,680,738	3,104,033	1,675,949	8,158,450	20,564,238
1901	3,597,089	3,697,408	3,041,869	1,805,996	9,303,541	21,445,903
1902	3,734,712	4,421,250	3,683,792	2,057,532	13,080,118	26,977,404
1903	3,686,214	4,093,320	3,422,341	1,918,584	13,452,812	26,573,271
1904	2,465,448	2,871,130	2,132,898	1,056,430	11,672,405	20,198,311
1905	3,772,645	4,472,630	3,344,551	1,578,626	20,156,566	33,325,018
1906	4,070,914	4,962,357	3,484,023	1,794,186	23,564,891	37,876,371
1907	4,167,810	4,779,592	3,609,519	1,724,217	27,245,441	41,526,579
1908	3,309,917	2,904,011	3,241,931	927,206	17,725,014	28,108,079
1909	4,291,967	4.789,362	3,807,157	1,097,444	27,877,705	41,863,635
Total	93,230,036	71,407,158	61,786,931	29,317,695	196,361,366	452,103,186

Shipments and receipts of Lake Superior ore.—During 1909, 41,683,599 long tons of iron ore were shipped from the Lake Superior district. Of this total 903,270 tons were shipped by rail, the remainder being Lake shipments. Details concerning the shipments and receipts of these ores are given in the following tables, which are taken from the Iron Trade Review:

Shipments of Lake Superior iron ore, 1904–1909, in long tons.[a]

Shipping port.	1904.	1905.	1906.	1907.	1908.	1909.
Two Harbors	4,566,542	7,779,850	8,180,125	8,188,906	5,702,237	9,181.132
Escanaba	3,644,267	5,307,938	5,851,050	5,761,988	3,351,502	5,747,801
Duluth	4,649,611	8,807,559	11,220,218	13,448,736	8,808,168	13,470,503
Ashland	2,288,400	3,485,344	3,388,106	3,436,867	2,513,670	3,834,207
Marquette	1,907,301	2,977,828	2,791,033	3,013,826	1,487,487	2,909,451
Superior	4,169,990	5,118,385	6,083,057	7,440,386	3,564,030	6,540,505
Gladstone	553					
Total	21,226,664	33,476,904	37,513,589	41,290,709	25,427,094	41,683,599
All-rail shipments	622,737	907,212	1,052,173	975,959	587,893	903,270
Grand total	21,849,401	34,384,116	38,565,762	42,266,668	26,014,987	42,586,869

[a] Iron Trade Review.

Iron-ore receipts at Lake Erie ports, 1904–1909, in long tons.[a]

Port.	1904.	1905.	1906.	1907.	1908.	1909.
Ashtabula, Ohio	3,639,250	6,373,779	6,833,352	7,521,859	3,012,064	8,056,941
Cleveland, Ohio	3,572,228	5,854,745	6,604,661	6,495,998	4,240,816	6,051,342
Conneaut, Ohio	4,083,655	5,327,552	5,432,370	5,875.937	4,798,631	7,007,834
Buffalo and Tonawanda, N. Y.	2,433,601	3,774,928	4,928,331	5,580,438	2,835,099	5,002,235
Erie, Pa	1,284.778	2,112,476	1,986,539	2,294,239	828,602	1,235,057
Fairport, Ohio	1,157,858	2,008,621	1,861,498	2,437,649	1,518,961	1,734,277
Toledo, Ohio	508.793	1,006,855	1,423,741	1,314,140	680,553	1,374,224
Lorain, Ohio	972,931	1,605,823	2,191,965	2,621,025	2,286,388	2,796,856
Huron, Ohio	231,364	825.278	778,453	971,430	213,377	243,082
Sandusky, Ohio	48,356	51,202	35.847	83,043		11,088
Total	17,932,814	28,941,259	32,076,757	35,195,758	20,414,491	33,512,936

[a] Iron Trade Review.

The following table shows the total quantity of iron ore shipped from the Lake Superior district since 1854, the date of the opening of the Marquette range, the oldest of the Lake Superior ranges. This table gives the shipments as collected by the Iron Trade Review and is inserted for comparison with the table giving the total production of the Lake Superior district, without regard to shipments:

Shipments of iron ore from the Lake Superior region, 1854–1909, in long tons.

Year.	Quantity.	Year.	Quantity.	Year.	Quantity.
1854	3,000	1874	919,557	1894	7,748,932
1855	1,449	1875	891,257	1895	10,429,037
1856	36,343	1876	992,764	1896	9,934,828
1857	25,646	1877	1,015,087	1897	12,469,638
1858	15,876	1878	1,111,110	1898	14,024,673
1859	68,832	1879	1,375,691	1899	18,251,804
1860	114,401	1880	1,908,745	1900	19,059,393
1861	49,909	1881	2,306,505	1901	20,589,237
1862	124,169	1882	2,965,412	1902	27,571,121
1863	203,055	1883	2,353,288	1903	24,289,878
1864	243,127	1884	2,518,692	1904	21,822,839
1865	236,208	1885	2,466,372	1905	34,384,116
1866	278,796	1886	3,568,022	1906	38,565,762
1867	473,567	1887	4,730,577	1907	42,266,668
1868	491,449	1888	5,063,693	1908	26,014,987
1869	617,444	1889	7,292,754	1909	42,586,869
1870	830,940	1890	9,012,379		
1871	779,607	1891	7,062,233	Total	449,351,145
1872	900,901	1892	9,069,556		
1873	1,162,458	1893	6,060,492		

Stocks of iron ore at Lake Erie ports.—At the close of navigation in 1909 the stocks of iron ore at the Lake Erie ports exceeded those of the same date in 1908 by 524,256 tons; and the stocks of 1908 exceeded those of 1907 by more than 1,000,000 tons.

The following statistics from the Iron Trade Review contain data as to the stocks of iron ore at the Lake Erie ports at the close of navigation and at the opening of navigation for the last six years:

Stocks of iron ore at lower Lake ports, December 1, 1904–1909, in long tons.[a]

Port.	At close of navigation, December 1—					
	1904.	1905.	1906.	1907.	1908.	1909.
Ashtabula, Ohio	1,403,575	1,589,951	1,631,312	2,056,820	2,293,531	2,594,359
Cleveland, Ohio	1,237,033	1,330,619	1,224,606	1,281,335	1,458,392	1,547,142
Fairport, Ohio	660,420	759,961	590,783	523,981	835,821	867,640
Erie, Pa	583,439	564,961	552,631	652,219	730,530	788,046
Lorain, Ohio	299,504	271,695	336,321	366,271	426,274	407,129
Conneaut, Ohio	684,487	976,976	1,057,424	1,090,774	1,296,675	1,411,002
Toledo, Ohio	318,573	368,024	281,000	518,645	590.925	332,456
Huron, Ohio	182,495	208,023	245,499	415,730	458,158	477.333
Buffalo, N. Y	318,739	315,780	315,412	435,407	315,148	501,125
Sandusky, Ohio	75,134	52,977	17,467	44,546	36,079	39,557
Total	5,763,399	6,438,967	6,252,455	7,385,728	8,441,533	8,965,789

[a] Iron Trade Review, May 13, 1909, and May 12, 1910.

Stocks of iron ore at lower Lake ports, May 1, 1905–1910, in long tons.[a]

Port.	At opening of navigation, May 1—					
	1905.	1906.	1907.	1908.	1909.	1910.
Ashtabula, Ohio	623,451	462,564	568,485	1,799,454	1,392,430	1,609,931
Cleveland, Ohio	513,559	350,382	447,573	1,029,198	1,018,055	985,725
Fairport, Ohio	390,869	266,162	154,246	225,328	562,679	541,299
Erie, Pa	236,414	169,488	189,276	595,660	557,029	550,187
Lorain, Ohio	165,586	140,452	176,300	327,052	362,096	205,445
Conneaut, Ohio	96,295	148,528	139,853	462,392	497,203	461,365
Toledo, Ohio	71,642	52,550	147,397	217,788	380,675	366,631
Huron, Ohio	68,100	80,738	98,106	392,731	379,364	336,693
Buffalo, N. Y	61,271	90,906	50,313	388,441	189,209	364,336
Sandusky, Ohio	44,444	29,320	5,439	42,256	31,528	22,468
Total	2,271,631	1,791,090	1,976,988	5,480,300	5,370,268	5,444,080

[a] Iron Trade Review, May 13, 1909, and May 12, 1910.

Prices of Lake Superior iron ores.—In the following table are given the prices of Lake Superior iron ores at the lower Lake ports during 1908 and 1909.

The base for the Bessemer ores is a metallic iron content of 55 per cent; that of the non-Bessemer ores is a metallic iron content of 51.5 per cent.

Prices per long ton of Lake Superior iron ores at lower Lake ports, 1908–9.

	1908.		1909.
	Until June 15.	After June 15.	
Old Range:			
Bessemer	$5.00	$4.50	$4.50
Non-Bessemer	4.20	3.70	3.70
Mesabi:			
Bessemer	4.75	4.25	4.25
Non-Bessemer	4.00	3.50	3.50

FOREIGN TRADE IN IRON ORE.

IMPORTS.

The quantity of iron ore imported into the United States in 1909 exceeded the imports of any year heretofore recorded. The imports of 1909 exceeded those of 1908 by more than 118 per cent. Part of this increase was due to the lowering of the tariff on foreign ores from 40 cents per ton to 15 cents per ton, according to the Payne-Aldrich bill, which became a law on August 5, 1909. About 54.7 per cent of the imports were from Cuba, about 17.3 per cent from Spain, about 7 per cent from Sweden, and the bulk of the rest was from Newfoundland, the imports from which increased nearly 365 per cent over those of 1908. The statistics with regard to imports are furnished by the Bureau of Statistics of the Department of Commerce and Labor.

In the following table are shown the imports of iron ore from the various countries from 1906 to 1909, inclusive:

Quantity and value of iron ore imported into the United States in the calendar years 1906–1909, by countries, in long tons.

Country.	1906.		1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Cuba	639,362	$2,178,997	657,133	$2,522,710	579,668	$1,756,091	927,774	$2,681,028
Spain	171,870	418,922	296,318	760,801	126,074	331,070	291,547	664,460
French Africa	....	....	65,940	252,897	....	....	37,208	67,515
Greece	48,630	61,560	23,800	42,927	4,850	5,311	19,080	21,782
Newfoundland and Labrador	[a] 125,395	125,395	89,685	97,735	48,285	48,285	224,395	330,056
United Kingdom	231	1,955	5,765	16,491	2,028	32,027	869	12,846
Germany	1,084	8,949	273	2,096	602	4,052	3	100
Netherlands	50	474	500	3,673	....	....	....	....
Canada	57,890	100,125	26,878	51,328	5,013	16,321	27,155	84,613
Belgium	400	6,662	125	1,102	1	28	3	179
Norway	9,278	37,240	....	....	....	....	....	....
Russia in Europe	....	....	....	....	....	....	32,010	62,418
Sweden	....	....	....	....	4,617	15,783	120,564	627,315
East Indies—British India	6,200	27,155	....	....	....	....	....	....
Other countries	....	....	62,751	185,723	5,760	15,280	[b] 14,349	26,766
Total	1,060,390	2,967,434	1,229,168	3,937,483	776,898	2,224,248	1,694,957	4,579,078

[a] Newfoundland only.
[b] Other countries in 1909: Colombia and Mexico.

The following table shows the imports of iron ore into the United States from 1906 to 1909, inclusive, by ports of entry:

Quantity and value of iron ore imported into the United States in the calendar years 1906–1909, by customs districts, in long tons.

Customs district.	1906.		1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Baltimore	617,866	$1,937,610	639,602	$2,436,457	248,875	$844,436	628,577	$1,838,762
Boston	159	1,218	479	2,071	21	61	7	29
Charleston	....	....	500	3,673	500	3,070	....	....
Fernandina	50	474	....	....	....	....	....	....
New York	3,475	8,400	7,405	19,989	4,392	17,424	47,285	93.277
Perth Amboy	290	1,450	....	....	1,355	23,637	....	....
Philadelphia	383,651	914,242	554,104	1,422,503	516,619	1,318,182	991,983	2,559,760
Savannah	....	....	100	630	....	....	....	....
Alaska	3	6	....	....	....	....	....	....
Los Angeles	859	6,940	....	....	51	501	....	....
Puget Sound	9	77	1,976	6,365	....	....	....	....
San Francisco	100	925	100	832	50	446	....	....
Buffalo Creek	124	280	172	96	....	....	141	489
Champlain	55	140	5	20	10	30	40	75
Cuyahoga	46,630	83,418	18,866	33,393	1,712	3,030	3,500	15,250
Detroit	4,863	8,007	....	....	....	....	25	777
Erie	2,162	3,827	5,400	9,558	....	....	4,000	16,700
Miami	....	....	....	....	2,569	9,403	18,106	46,106
Niagara	....	....	292	652	23	40	596	2,310
Oswegatchie	41	42	....	....	23	60	....	....
Vermont	53	378	167	1,244	676	3,758	455	2,054
St. Louis	....	....	....	....	22	170	....	....
Genesee	....	....	....	....	....	....	17	895
Other districts	....	....	....	....	....	....	225	2,594
Total	1,060,390	2,967,434	1,229,168	3,937,483	776,898	2,224,248	1,694,957	4,579,078

In the following table is shown the importation of iron ore into the United States as far as has been recorded. Iron ore was imported from Europe in large quantities for the first time in 1879, most of the ore prior to that date coming from Canada.

Imports of iron ore into the United States, 1872–1909, in long tons.

Year.	Quantity.	Year.	Quantity.	Year.	Quantity.
1872	23,733	1884	487,820	1897	489,970
1873	45,981	1885	390,786	1898	187,208
1874	57,987	1886	1,039,433	1899	674,082
1875	56,655	1887	1,194,301	1900	897,831
1876	17,284	1888	587,470	1901	966,950
1877	30,669	1889	853,573	1902	1,165,470
1878	28,212	1890	1,246,830	1903	980,440
1879 [a]	150,197	1891	912,864	1904	487,613
1879 [b]	284,141	1892	806,585	1905	845,651
1880	493,408	1893	526,951	1906	1,060,390
1881	782,887	1894	167,307	1907	1,229,168
1882	589,655	1895	524,153	1908	776,898
1883	490,875	1896	682,806	1909	1,694,957

[a] Fiscal years end.

[b] Calendar years begin.

EXPORTS.

The quantity of iron ore exported from the United States in 1909 amounted to 455,934 long tons, an increase of more than 47 per cent over iron-ore exports in 1908.

In the following table is shown the exportation of iron ores from the United States by customs districts from 1906 to 1909, inclusive. The data regarding exports are collected by the Bureau of Statistics, Department of Commerce and Labor.

Quantity and value of iron ore exported from the United States, 1906–1909, by customs districts, in long tons.

Customs district.	1906.		1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Newport News	171	$940	77	$419				
New York	115	930						
Norfolk and Portsmouth			18	240			3	$27
Arizona			206	1,098				
Buffalo Creek					25	$140	336	1,506
Champlain	15,226	45,692	14,855	44,595	7,359	22,517	9,417	27,170
Detroit			4	47	4	46		
Duluth	165,780	561,316	43,513	150,722	52,509	187,059	129,231	471,088
Huron	28	169						
Memphremagog	43	143						
Niagara			60	195	3,097	7,289	6,887	21,819
Superior	83,877	162,649	219,761	565,644	244,408	789,306	306,270	830,415
Vermont			114	462	1,697	6,567		
Puget Sound							3,790	13,300
Total	265,240	771,839	278,608	763,422	309,099	1,012,924	455,934	1,365,325

The quantity of iron ore exported from the United States, as far as has been recorded, is shown in the following table:

Exports of iron ore from the United States, 1899 to 1909, in long tons.

Year.	Quantity.	Year.	Quantity.
1899	40,665	1905	208,017
1900	51,460	1906	265,240
1901	64,703	1907	278,208
1902	88,445	1908	309,099
1903	80,611	1909	455,934
1904	213,865		

IRON-ORE INDUSTRY OF CUBA.

The iron ores which have been mined in Cuba up to the present time consist largely of hematite and magnetite and are obtained near Santiago, in the province of Oriente (Santiago). Recently large deposits of brown ore have been attracting considerable attention, especially those of the Mayari and Moa fields in Oriente Province and those of the Cubitas field in Camaguey Province. No ores of this type were reported as mined in 1909, but there was a considerable production in 1910.

The following table shows the shipments of iron ore from Cuba since the opening of the mines in 1884. The statistics of the Cuban iron-ore production were collected by the United States Geological Survey.

Shipments of iron ore from mines in the province of Oriente (Santiago), 1884–1909, in long tons.

Year.	Juragua Iron Co. (Limited).	Sigua Iron Co.	Spanish-American Iron Co.	Cuban Steel Ore Co.	Ponupo Manganese Co.	Total.
1884	25,295					25,295
1885	80,716					80,716
1886	112,074					112,074
1887	94,240					94,240
1888	206,061					206,061
1889	260,291					260,291
1890	363,842					363,842
1891	264,262					264,262
1892	335,236	6,418				341,654
1893	337,155	14,020				351,175
1894	156,826					156,826
1895	307,503		74,991			382.494
1896	298,885		114,110			412,995
1897	[a] 248,256		[b] 206,029			454,285
1898	83,696		84,643			168,339
1899	161,783		215,406			377,189
1900	154,871		292,001			446,872
1901	199,764		[c] 334,833	17,651		552,248
1902	221,039		455,105	23,590		699,734
1903	155,898		467,723			623,621
1904	31,162		356,111			387,273
1905	139,828		421,331			561,159
1906	133,379		507,195			640,574
1907	181,063		500,330			681,393
1908	366,580		452,854			819,434
1909	356,659		514,066		59,721	930,446

[a] Of this quantity, 5,932 tons were sent to Pictou, Nova Scotia.
[b] Of this quantity, 51,537 tons were sent to foreign ports.
[c] Of this quantity, 12,691 tons were sent to foreign ports.

WORLD'S PRODUCTION OF IRON ORE.

The latest available statistics with regard to the world's production of iron ore are shown in the following table. Of the figures in this table, those of the United States, Great Britain, Cuba, Canada, India, and Australia are in long tons; those of the other countries are in metric tons.

World's production of iron ore in 1907 and 1908, by countries.

Country.	1907.	1908.
	Tons.	*Tons.*
United States	51,720.619	35,983,336
Germany and Luxemburg	27,697,128	24,278,151
United Kingdom	15,731,604	15,031,025
Spain	9,896,178	9,271,592
France	10,008,478	10,057,145
Russia	5,700,000	(a)
Sweden	4,480,070	4,713,160
Austria-Hungary	4,356,804	4,718,700
Canada, Newfoundland	887,321	[b] 935,154
Cuba	819,434	930,446
Algeria	973,445	943,424
Greece	768,863	515,368
Italy	517,952	539,120
Belgium	316,250	188,780
China [c]	105.489	133,458
India	67,839	59,224
Japan	(a)	(a)
Norway	140.804	119,656
Australia	3,000	55,194

[a] Not available. [b] Newfoundland only. [c] Exports.

IRON AND STEEL INDUSTRY OF THE UNITED STATES.[a]

PRODUCTION OF PIG IRON BY STATES.

During 1909 the production of pig iron amounted to 25,795,471 long tons, as compared with 15,936,018 long tons in 1908 and with 25,781,361 long tons in 1907. The 1909 production was greater than that of any year heretofore recorded.

In the following table the pig-iron production of the United States is given, by States, for 1907, 1908, and 1909:

Production of pig iron, 1907–1909, by States.

State.	Blast furnaces.				Production, including spiegeleisen and ferromanganese, in long tons.		
	In blast June 30, 1909.	December 31, 1909.			1907.	1908.	1909.
		In.	Out.	Total.			
Pennsylvania	103	134	28	162	11,348,549	6,987,191	10,918,824
Ohio	44	61	13	74	5,250,687	2,861,325	5,551,545
Illinois	19	23	3	26	2,457,768	1,691,944	2,467,156
Alabama	19	29	22	51	1,686,674	1,397,014	1,763,617
New York	15	17	11	28	1,659,752	1,019,495	1,733,675
Virginia	9	13	13	26	478,771	320,458	391,134
Tennessee	9	13	8	21	393,106	290,826	333,845
Colorado	3	3	3	6	468,486	313,071	382,766
Missouri	2	2	0	2			
Oregon	0	0	1	1			
Washington	0	0	1	1			
California	0	0	0	0			
Maryland	3	4	1	5	411,833	183,502	286,856
New Jersey	3	5	6	11	373,189	225,372	294,474
Wisconsin	5	6	1	7	322,083	148,938	348,177
Minnesota	1	1	0	1			
Indiana	5	7	0	7	436,507	348,096	964,289
Michigan	7	11	4	15			
West Virginia	3	3	1	4	291,066	65,551	228,282
Kentucky	3	2	6	8	127,946	45,096	86,371
Georgia	1	0	4	4	55,825	24,345	26,072
Texas	0	0	4	4			
Connecticut	3	2	1	3	19,119	13,794	18,388
Massachusetts	1	2	0	2			
Total	258	338	131	469	25,781,361	15,936,018	25,795,471

The accompanying diagram (fig. 2) illustrates the course of the manufacture of pig iron, by months, in 1907, 1908, and 1909. The sudden decline in production of pig iron at the close of October, 1907, the low production during the first half of 1908, the slow recovery of activity in the last half of 1908, the hesitating conditions early in 1909, and finally the steady and rapid increase in production during the last part of the year, the month of December leading with a record production of more than 2,682,000 tons, are all strikingly displayed.

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[a] The pig iron and steel statistics in the following pages were collected and published by James M. Swank, general manager of the American Iron and Steel Association, in his annual statistical reports.

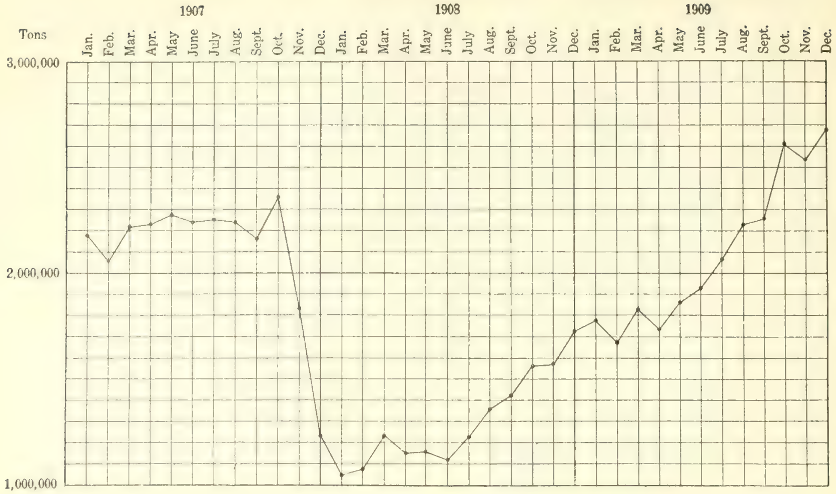

FIGURE 2.—Curve showing production of pig iron in the United States in 1907, 1908, and 1909, by months.

[Tonnage by months according to the Iron Trade Review, January 6, 1910.]

PRODUCTION OF PIG IRON BY GRADES.

The following table shows the production of different grades of pig iron from 1905 to 1909:

Production of pig iron in the United States, 1905–1909, by grades, in long tons.

Grade.	1905.	1906.	1907.	1908.	1909.
Bessemer and low phosphorus	12,407,116	13,840,518	13,231,620	7,216,976	10,557,370
Basic (mineral fuel)	4,105,179	5,018,674	5,375,219	4,010,144	8,250,225
Forge pig iron	727,817	597,420	683,167	457,164	725,624
Foundry and ferrosilicon	4,758,038	4,773,011	5,151,209	3,637,622	5,322,415
Malleable Bessemer	635,236	699,701	920,290	414,957	658,048
Spiegeleisen	227,797	244,980	283,430	111,376	142,831
Ferromanganese	62,186	55,520	55,918	40,642	82,209
White, mottled, direct castings, etc	69,011	77,367	80,508	47,137	56,749
Total	22,992,380	25,307,191	25,781,361	15,936,018	25,795,471

PRODUCTION OF PIG IRON ACCORDING TO FUEL USED.

In the following table is given the production of pig iron according to the fuel used from 1905 to 1909, inclusive:

Production of pig iron according to fuel used, 1905–1909, in long tons.

Fuel used.	1905.	1906.	1907.	1908.	1909.
Bituminous, chiefly coke	20,964,937	23,313,498	23,972,410	15,331,863	24,721,037
Anthracite and coke	1,644,424	1,535,614	1,335,286	353,315	682,383
Anthracite alone	30,091	25,072	36,268	1,694	16,048
Charcoal	352,928	433,007	437,397	249,146	376,003
Total	22,992,380	25,307,191	25,781,361	15,936,018	25,795,471

TOTAL PRODUCTION OF PIG IRON.

The following table shows the production of pig iron in the United States as far as has been recorded. The statistics for 1854 and all succeeding years were collected by the American Iron and Steel Association; those for 1810, 1840, and 1850 are census figures; those for the other years are largely estimates by early statisticians.

Production of pig iron in the United States, 1810–1909, in long tons.

Year.	Quantity.	Year.	Quantity.	Year.	Quantity.
1810	53,908	1863	846,075	1887	6,417,148
1820	20,000	1864	1,014,282	1888	6,489,738
1828	130,000	1865	831,770	1889	7,603,642
1829	142,000	1866	1,205,663	1890	9,202,703
1830	165,000	1867	1,305,023	1891	8,279,870
1831	191,000	1868	1,431,250	1892	9,157,000
1832	200,000	1869	1,711,287	1893	7,124,502
1840	286,903	1870	1,665,179	1894	6,657,388
1842	215,000	1871	1,706,793	1895	9,446,308
1846	765,000	1872	2,548,713	1896	8,623,127
1847	800,000	1873	2,560,963	1897	9,652,680
1848	800,000	1874	2,401,262	1898	11,773,934
1849	650,000	1875	2,023,733	1899	13,620,703
1850	563,755	1876	1,868,961	1900	13,789,242
1852	500,000	1877	2,066,594	1901	15,878,354
1854	657,337	1878	2,301,215	1902	17,821,307
1855	700,159	1879	2,741,853	1903	18,009,252
1856	788,515	1880	3,835,191	1904	16,497,033
1857	712,640	1881	4,144,254	1905	22,992,380
1858	629,548	1882	4,623,323	1906	25,307,191
1859	750.560	1883	4,595.510	1907	25,781,361
1860	821,223	1884	4,097.868	1908	15,936,018
1861	653,164	1885	4,044.526	1909	25,795,471
1862	703.270	1886	5,683,329		

PRICES OF PIG IRON.

In the following table are given the average monthly prices of the principal kinds of pig iron for 1908 and 1909:

Average monthly prices per ton of pig iron, 1908 and 1909, by months and kinds.

Month.	1908.				1909.			
	No. 2 foundry pig iron at Pittsburg.	Gray forge pig iron at Pittsburg.	Bessemer pig iron at Pittsburg.	Basic pig iron at Philadelphia.	No. 2 foundry pig iron at Pittsburg.	Gray forge pig iron at Pittsburg.	Bessemer pig iron at Pittsburg.	Basic pig iron at Philadelphia.
January	$17.90	$17.00	$19.00	$17.10	$16.28	$15.40	$17.34	$16.75
February	16.90	15.99	17.90	17.25	15.90	15.09	16.77	16.56
March	16.90	15.90	17.86	17.25	15.62	14.65	16.34	15.75
April	16.40	15.45	17.49	17.25	15.06	14.40	15.80	15.00
May	15.90	14.90	16.96	16.37	15.08	14.40	15.84	15.12
June	15.90	14.90	16.90	15.50	15.63	14.77	16.02	15.50
July	15.90	14.90	16.83	15.10	15.96	14.85	16.40	15.80
August	15.65	14.71	16.26	15.00	16.20	15.21	17.02	17.06
September	15.40	14.46	15.90	15.44	17.03	16.15	18.05	18.10
October	15.40	14.40	15.75	15.80	18.02	17.02	19.52	18.37
November	16.40	14.90	16.59	16.19	18.09	17.27	19.90	18.81
December	16.65	15.25	17.40	16.70	17.90	17.40	19.90	18.75

PRODUCTION OF STEEL BY STATES AND KINDS.

The year 1908 marked an epoch in steel making, as during this year the production of open-hearth steel passed that of Bessemer steel.

The records of the year 1909 show that, although the production of Bessemer steel greatly surpassed that of 1908, the decline in the output of this variety of steel apparently has begun, for it fell below that of any other year since 1904.

The following table shows the production of Bessemer steel ingots and castings in the leading States from 1905 to 1909, inclusive:

Production of Bessemer ingots and castings, 1905–1909, by States, in long tons.

State.	1905.	1906.	1907.	1908.	1909.
Pennsylvania	4,491,445	4,827,725	4,351,841	2,106,382	2,845,602
Ohio	3,131,149	3,769,913	3,636,679	1,955,446	3,466,077
Illinois	1,651,250	1,684,772	1,723,073	1,237,747	1,632,444
Other States	1,667,531	1,993,420	1,955,956	817,180	1,386,660
Total	10,941,375	12,275,830	11,667,549	6,116,755	9,330,783

In the following table is given the production of open-hearth steel ingots and castings in the leading States from 1905 to 1909, inclusive:

Production of open-hearth steel ingots and castings, 1905–1909, by States, in long tons.

State.	1905.	1906.	1907.	1908.	1909.
New England	239,282	251,047	239,797	158,417	257,392
New York and New Jersey	348,072	553,186	706,019	350,348	618,117
Pennsylvania	6,471,818	7,718,213	7,868,353	5,322,229	9,400,287
Illinois	617,625	884,472	1,013,251	483,104	1,052,572
Ohio	687,392	818,683	819,642	525,171	1,424,452
Other States	607,187	754,812	902,674	997,460	1,741,116
Total	8,971,376	10,980,413	11,549,736	7,836,729	14,493,936

The following table gives the production, by States, of basic and acid open-hearth steel ingots and castings in 1909:

Production of basic and acid open-hearth steel ingots and castings in 1909, by States, in long tons.

State.	Basic open-hearth steel.	Acid open-hearth steel.	Total.
New England	198,522	58,870	257,392
New York and New Jersey	547,282	70,835	618,117
Pennsylvania	8,624,189	776,098	9,400,287
Illinois	1,039,247	13,325	1,052,572
Ohio	1,345,994	78,458	1,424,452
Other States	1,662,238	78,878	1,741,116
Total	13,417,472	1,076,464	14,493,936

The following table gives the production of all kinds of steel ingots and castings in 1908 and 1909:

Production of all kinds of steel ingots and castings in 1908 and 1909, by States, in long tons.

State.	1908.				1909.			
	Bessemer.	Open-hearth.	Crucible and all other.	Total ingots and castings.	Bessemer.	Open-hearth.	Crucible and all other.	Total ingots and castings.
Massachusetts, Rhode Island, and Connecticut	837	158,417	3,344	162,598	1,174	257,392	3,562	262,128
New York and New Jersey	351,794	350,348	19,911	722,053	602,046	618,117	34,930	1,255,093
Pennsylvania	2,106,382	5,322,229	37,254	7,465,865	2,845,602	9,400,287	63,900	12,309,789
Delaware, Maryland, District of Columbia, Virginia, West Virginia, Kentucky, Georgia, and Alabama[a]	375,756	499,096	....	874,852	751,921	512,650	70	1,264,641
Ohio	1,955,446	525,171	1,172	2,481,789	3,466,077	1,424,452	2,145	4,892,674
Indiana and Illinois	1,237,747	650,403	4,736	1,892,886	1,632,444	1,836,529	19,704	3,488,677
Other States	88,793	331,065	3,346	423,204	31,519	444,509	5,991	482,019
Total	6,116,755	7,836,729	69,763	14,023,247	9,330,783	14,493,936	130,302	23,955,021

[a] 1909 figures include Louisiana and Texas.

TOTAL PRODUCTION OF STEEL.

The statistics of the production of various kinds of steel, so far as has been recorded, are given in the following table. The first steel produced in this country was probably made in Connecticut in 1728 by Samuel Higley and Joseph Dewey. Crucible steel was first successfully produced in the United States in 1832 at the works of William and John H. Garrard, at Cincinnati, Ohio. Bessemer steel was first made in this country in September, 1864, by William F. Durfee at an experimental plant at Wyandotte, Mich., and open-hearth steel in 1864 by the New Jersey Steel and Iron Company at Trenton, N. J.

Production of steel in the United States, 1810–1909, in long tons.

Year.	Bessemer.	Open-hearth.	Crucible.	Other steel.	Total.
1810	....	....	917		917
1860	....	....	11.838		11,838
1863	....	....	8,075		8,075
1864	....	....	9,258		9,258
1865	....	....	13,627		13,627
1866	....	....	16,940		16,940
1867	2,679	....	16,964		19.643
1868	7,589	....	19,197		26,786
1869	10,714	893	19,643		31,250
1870	37,500	1,339	29,911		68,750
1871	40,179	1,785	31.250		73.214
1872	107,239	2,679	26,125	6,911	142,954
1873	152,368	3,125	31,059	12,244	198,796
1874	171,369	6,250	32,436	5,672	215,727
1875	335,283	8,080	35,180	11,256	389,799
1876	469,639	19,187	35,163	9,202	533,191
1877	500,524	22,349	36.098	10,647	569,618
1878	653,773	32,255	38,309	7,640	731,977
1879	829,439	50,259	50,696	4,879	935,273
1880	1,074,262	100,851	64,664	7,558	1,247,335
1881	1,374,247	131,202	80,145	2,720	1,588,314

Production of steel in the United States, 1810–1909, in long tons—Continued.

Years.	Bessemer.	Open-hearth.	Crucible.	Other steel.	Total.
1882	1,514,687	143,341	75,973	2,691	1,736,692
1883	1,477,345	119,356	71,835	4,999	1,673,535
1884	1,375,531	117,515	53,270	4,563	1,550,879
1885	1,519,430	133,376	57,599	1,515	1,711,920
1886	2,269,190	218,973	71,973	2,367	2,562,503
1887	2,936,033	322,069	75,375	5,594	3,339,071
1888	2,511,161	314,318	70,279	3,682	2,899,440
1889	2,930,204	374,543	75,865	5,120	3,385,732
1890	3,688,871	513,232	71,175	3,793	4,277,071
1891	3,247,417	579,753	72,586	4,484	3,904,240
1892	4,168,435	669,889	84,709	4,548	4,927,581
1893	3,215,686	737,890	63,613	2,806	4,019,995
1894	3,571,313	784,936	51,702	4,081	4,412,032
1895	4,909,128	1,137,182	67,666	858	6,114,834
1896	3,919,906	1,298,700	60,689	2,394	5,281,689
1897	5,475,315	1,608,671	69,959	3,012	7,156,957
1898	6,609,017	2,230,292	89,747	3,801	8,932,857
1899	7,586,354	2,947,316	101,213	4,974	10,639,857
1900	6,684,770	3,398,135	100,562	4,862	10,188,329
1901	8,713,302	4,656,309	98,513	5,471	13,473,595
1902	9,138,363	5,687,729	112,772	8,386	14,947,250
1903	8,592,829	5,829,911	102,434	9,804	14,534,978
1904	7,859,140	5,908,166	83,391	9,190	13,859,887
1905	10,941,375	8,971,376	102,233	8,963	20,023,947
1906	12,275,830	10,980,413	127,513	14,380	23,398,136
1907	11,667,549	11,549,736	131,234	14,075	23,362,594
1908	6,116,755	7,836,729	63,631	6,132	14,023,247
1909	9,330,783	14,493,936	107,355	22,947	23,955,021

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[a] Numbers of folios containing important articles on iron ores are printed in italics.

MOVEMENT OF LAKE SUPERIOR IRON ORE IN 1909.

By JOHN BIRKINBINE.

The map published by the United States Geological Survey illustrating the movement of Lake Superior iron ore in 1902 was received with such favor that a revised map, indicating the changed conditions in 1909, has been prepared and is published herewith. The general scheme of the two maps is identical, except in so far as the arrangement of lines to indicate quantities is concerned. The increase in tonnage in the eight years from 1902 to 1909, inclusive, is shown by the table prepared from data supplied by the Iron Trade Review.

SHIPMENTS OF LAKE SUPERIOR IRON ORE, 1902-1909, BY RANGES.

The following table shows the shipments, by ranges, of Lake Superior iron ore from 1902 to 1909, inclusive.

Approximate shipments of Lake Superior iron ore, 1902-1909, by ranges, in long tons.[a]

[The figures in black-face type represent maximum yearly shipments from each range.]

Year.	Marquette.	Menominee.	Gogebic.	Mesabi.	Vermilion.	Total.
1902	3,868,025	4,612,509	3,654,929	13,342,840	**2,084,263**	27,562,566
1903	3,040,245	3,749,567	2,912,708	12,892,542	1,676,699	24,271,761
1904	2,843,703	3,074,848	2,398,287	12,156,008	1,282,513	21,755,359
1905	4,215,572	4,495,451	3,705,207	20,158,699	1,677,186	34,252,115
1906	4,057,187	**5,109,088**	3,643,514	23,819,029	1,792,355	38,421,173
1907	**4,388,073**	4,964,728	3,637,102	27,495,708	1,685,267	42,170,878
1908	2,414,632	2,679,156	2,699,856	17,257,350	841,544	25,892,538
1909	4,256,172	4,875,385	**4,088,057**	**28,176,281**	1,108,215	**42,504,110**

[a] This does not include the relatively small shipments from Canada which are indicated on the map.

TOTAL PRODUCTION OF LAKE SUPERIOR IRON ORE, BY RANGES.

The total contribution to the iron-ore supply of the United States made to the close of 1909 by each of the ranges included in the Lake Superior district is as follows:

Total production of Lake Superior iron ore, by ranges, in long tons.

Mesabi	195,703,424
Marquette	91,903,991
Menominee	71,313,115
Gogebic	60,820,503
Vermilion	29,125,385
	[a] 448,966,418

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[a] These figures do not include stocks of ore which have accumulated at the mines.

RESOURCES OF LAKE SUPERIOR DISTRICT.

The iron-ore industry in the Lake Superior district has shown marked activity in the last eight years. It will be noted that the Marquette range in Michigan, the oldest of the producing ranges, first shipping in 1854, and its southern neighbor, the Menominee range, in Michigan and Wisconsin, the second in development, being opened in 1877, both show increased annual outputs, and that the Gogebic range, in the same States but farther west, which made its first shipment in 1884, also shows a gain. It is interesting to note that in these older ranges few mines have been abandoned. In fact, there are more mines that may be considered as new finds or reopenings of old mines than will offset the suspension of operations at those which have been active for years, and the large expenditures in installation of equipment for permanent shafts—some being concrete lined, with steel headworks, electric power, and lighting facilities—all point to a faith in the continued activity of these ranges.

The only range which suggests a decline is the Vermilion, in Minnesota, which was opened in 1884 and which in 1909 produced 1,000,000 tons less than in 1902; but this loss is considered to be due to the policy of the owners rather than to the exhaustion of the ore supply. Within the eight years under discussion the Chandler mine, which in twenty-one years contributed 9,500,000 tons, has ceased producing, although it is understood that it contains ore yet to be won and that the deposit which this mine worked extends into adjacent property, where it is still to be exploited.

The great advance has been in the Mesabi range, in Minnesota, opened in 1892, the shipments having increased from 13,300,000 tons in 1902 to 28,200,000 tons in 1909. This increase has resulted from the continued activity of the opened deposits and from the extension of the operations of the ore field beyond Mississippi River. In this district the expenditures for railroads, permanent mine equipment, and exploratory work indicate a faith in its future; and a contract made by the United States Steel Corporation (Great Western Mining Company) and the Great Northern Railway, as trustees, providing for an annually increasing output and also for annually increasing royalties from the leased properties, is another evidence that the Mesabi range may be expected to continue an important factor in the iron-ore supply. This is also emphasized by the report issued in 1908 of an exhaustive investigation by the Minnesota tax commission, which stated that a conservative estimate of the then known available iron-ore lands showed a reserve of 1,192,500,000 tons of iron ore, the bulk of which is on the Mesabi range.

The development of iron ores on the north side of Lake Superior, near Thunder Bay, and the continued activity on the Michipicoten range, together with the work done on the iron-ore deposits in Canada tributary to Lake Huron, are other features which point toward the permanence of the ore supply from the Great Lakes region.

STOCKS.

As navigation on the Great Lakes is limited to about seven months each year, large quantities of ore are accumulated at blast furnaces and at the receiving ports for distribution to consumers during the winter months. These stocks, though much depleted, are not exhausted by the time navigation opens again, and the movement of Lake Superior ores in the succeeding open season may be in excess of or below the actual consumption, the difference between shipments and consumption being measured by the stocks at the close of one season and the opening of the next.

The receiving docks, which have the highest type of unloading equipment, serve as reserves for the blast furnaces. At the close of navigation December 1, 1909, the stock of Lake Superior iron ore on the receiving docks of Lake Erie was nearly 9,000,000 long tons.

TRANSPORTATION AND DISTRIBUTION OF ORE.

TRANSPORTATION.

Notwithstanding the low freight charges due to the use of water transportation and the mechanical loading and unloading facilities provided, the shipments by rail from mines to consumers constitute an important factor in the transportation, amounting to 903,270 long tons in 1909, though representing but a small percentage of the total ore moved. These all-rail shipments are made to furnaces within convenient reach, or to those which can use the railroad as economically as to break bulk from car to vessel and again from vessel to car. They are also made in response to special requirements, such as in 1905, when about 100,000 tons of ore from the Mesabi range were sent by rail over 1,500 miles to meet an emergency at the blast furnaces at Pueblo, Colo.

Some ore is also used locally at blast furnaces near the producing mines or shipping docks, as at Duluth, Minn., Ashland, Wis., and Marquette and Escanaba, Mich. This can not be represented by the lines indicating quantities on the map. The same is true of the consumption of ore by plants on or close to the lakes, for the movement of these ores is not shown in the land lines indicating the distribution to consumers. Such points of consumption are Chicago, Ill., and vicinity; Gary, Ind.; Milwaukee, Wis.; Fruitford and Elk Rapids, Mich.; Sault Ste. Marie, Midland, and Deseronto, Canada; Detroit, Mich.; Toledo, Lorain, and Cleveland, Ohio; Erie, Pa.; and Buffalo and Tonawanda, N. Y.

DISTRIBUTION.

In 1909 the total shipment of Lake Superior iron ore amounted to 41,700,000 long tons, of which about 7,000,000 tons were distributed in Lake Michigan, and 33,700,000 tons reached ports on Lake Erie, a small quantity passing on to Lake Ontario and beyond.

On the accompanying map an effort has been made to show the movement of these iron ores from the Lake Superior district during the calendar year 1909. The relative quantities are indicated by lines—the heavy lines representing 5,000,000 tons; the lighter lines 1,000,000 tons; and the dotted lines less than 1,000,000 tons. The quantities are represented approximately in millions of long tons by whole numbers and decimals.

At the west end of Lake Superior water shipments, amounting to 29,200,000 long tons, coming from the Mesabi and Vermilion ranges, were made from Two Harbors and Duluth, Minn., and Superior, Wis. These were augmented to 33,000,000 long tons by the addition of 3,800,000 tons from the Gogebic range forwarded from Ashland, Wis., and were still further increased to 35,900,000 tons by shipments from the Marquette range, via Marquette, Mich., and by a small quantity from the Michipicoten range in Canada.

With the exception of a comparatively small tonnage required for local blast furnaces, this immense quantity passed through the Sault Ste. Marie canals and moved on to the Straits of Mackinac, where a part of the ore from the Lake Superior ports, together with some ore from the port of Escanaba (the point of shipment both for the Menominee range ores and for part of the Marquette range ores), proceeded down Lake Michigan to various ports, such as Milwaukee, Fruitport, Chicago, and Gary. Some of the furnaces at these ports also obtain considerable ore from local mines in Wisconsin. The remainder of the ore from Escanaba passed eastward through the Straits of Mackinac and, with the shipments from Moose Mountain, Ontario, joined the main column through Lake Huron, some being disposed of at Midland, Ontario, and Detroit, Mich., but the great bulk being distributed to the lower lake receiving docks at Toledo, Sandusky, Huron, Lorain, Cleveland, Fairport, Ashtabula, and Conneaut, Ohio, Erie, Pa., and Buffalo and Tonawanda, N. Y.

Most of the iron ore handled at lower lake ports is consumed in eastern Ohio and western Pennsylvania, about 23,000,000 long tons being sent in 1909 to the region tributary to Cleveland and Pittsburg. Ore is also delivered to central Ohio and to points along Ohio River. At Buffalo and Tonawanda, N. Y., 5,000,000 long tons were received, mostly for local use, although some of this was distributed by long rail hauls.

St. Louis, Mo., received a small quantity of Lake Superior ore by all-rail routes; about 80,000 tons went to Virginia; approximately 2,000,000 tons went to western Pennsylvania; and about 800,000 long tons were carried to eastern Pennsylvania and New Jersey in competition with local and foreign ores, with which they are mixed. A cargo of lake ore was carried to Cape Breton, and small shipments for special purposes reached New England and the Southern States.

TRANSPORTATION AND DISTRIBUTION OF OTHER IRON ORES.

The Lake Superior iron ores represent about 80 per cent of the total iron-ore production of the United States, and as they are handled by the best appliances for loading and unloading vessels they cover great distances. A considerable portion of the remainder of the iron ores, however, which do not come from the Lake Superior district, also presents interesting features of transportation.

Adirondack ores.—The eastern furnaces have important local sources of supply and draw ores from the Adirondack region of New York. Since its opening, between 1785 and 1790, that region has produced 36,000,000 tons, mainly from the Lake Champlain district, which supplies magnetite to furnaces in New Jersey, in eastern and central Pennsylvania, and also in western New York. In 1909 this district produced about 800,000 tons of iron ore, of which 300,000 tons were concentrates resulting from magnetic separation. The Lake Champlain mines shipped some 15,000 tons to Canada, and sent also considerable quantities of phosphoric tailings from the magnetic separators to assist Lake Erie furnaces in producing foundry pig iron.

Cornwall and Salisbury deposits.—In Pennsylvania the Cornwall deposit has been worked for one hundred and sixty years, and has produced 21,000,000 tons; it is still an important source of supply for local furnaces, the same being true of other deposits in Pennsylvania and New Jersey. In New England the Salisbury district has for years furnished a moderate supply of brown hematite ore. North Carolina, Kentucky, Maryland, West Virginia, Utah, Colorado, Nevada, Montana, Ohio, California, Oregon, and Washington also contribute small quantities of iron ore.

Alabama and other ores.—In the Birmingham district of Alabama the use of the iron ores produced is practically local; but in other sections of Alabama, Tennessee, Georgia, Texas, and Virginia ores are moved considerable distances, and some limonite from eastern Texas was delivered in 1909 at Alabama blast furnaces.

Wyoming and New Mexico ores.—The bulk of the ore supply for the Colorado Fuel and Iron Company, at Pueblo, Colo., is brought 350 miles from eastern Wyoming, and this is supplemented by ore which is hauled over 600 miles from northern New Mexico.

Cuban and other ores.—As already suggested the blast furnaces nearest the Atlantic Ocean depend upon a mixture of foreign and local ores, and also upon ores from northern New York supplemented by shipments from Lake Superior.

The foreign iron ores imported in 1909 aggregated 1,700,000 long tons, which is the maximum quantity imported in any one year; most of it was received at Philadelphia and Baltimore. Some of the eastern plants have iron-ore mines in Cuba, which contributed over one-half of the total imports in 1909. Little of the foreign iron ore is carried more than 100 miles from the Atlantic seaboard. To meet a prospective increase in this trade considerable expenditures for unloading facilities have already been made.

MANGANESE ORE.

By Ernest F. Burchard.

INTRODUCTION.

According to reports received by the United States Geological Survey, the manganese ore industry showed less activity in 1909 than in 1908. Manganese ore was mined in 1909 in California, Tennessee, and Virginia, but only in Virginia was the output of consequence. No production has been reported from South Carolina since 1907. The table of total production shows that only in three years, 1886, 1887, and 1888, has the production of manganese ore reached 25,000 tons annually and that during the last 10 years the industry has not been in a prosperous condition. In 1909 the quantity marketed amounted to 1,544 long tons, valued at $19,675, the price per ton averaging $12.74, as compared with 6,144 long tons, valued at $62,779, an average price per ton of $10.22, in 1908. In addition to the quantity shipped, a small tonnage was mined and remained in stock at the mines at the end of the year, but definite figures as to this stock are not available.

The greater part of the high-grade manganese ore mined in the United States is used in the manufacture of brick, glass, and chemicals. The importations of manganese ore greatly exceed the quantities mined in this country—a condition likely to continue so long as the principal sources of foreign supply are large and cheaply worked, ocean freights are low, and there is no tariff on the ore.

The production of manganiferous ores, which include manganiferous iron ores and manganiferous silver ores, increased notably in 1909, the total quantity reported being 843,689 long tons, as compared with 523,034 tons in 1908. The manganiferous iron ores for the most part contained less than 6 per cent metallic manganese and were used in the production of a high-manganese pig iron. The manganiferous silver ores were mined in Western States in connection with lead, zinc, and precious metals. Part of this product was used in the manufacture of spiegeleisen, and part was used as flux in the copper and silver smelters.

The production of manganiferous zinc residuum from New Jersey zinc ores in 1909 amounted to 141,264 long tons, as compared with 110,225 tons in 1908. The production of this material has shown a gain every year since 1905, with the exception of 1907.

SOURCES OF MANGANESE.[a]

The principal manganese minerals forming ores of manganese are the following:

Principal manganese minerals.

Mineral.	Composition.	Percentage of manganese.
Polianite	MnO_2	63.2
Pyrolusite	$MnO_2.n\ H_2O$	60–63
Psilomelane	$MnO_2.(MnKBa)O.n\ H_2O$	45–60
Wad	Hydrous impure mixture of manganese oxides.	Variable.
Manganite	$Mn_2O_3.H_2O$	62.4
Braunite	$3Mn_2O_3.MnO.SiO_2$	69
Franklinite	$(FeZnMn)O.(FeMn)_2O_3$	Variable.
Rhodochrosite	$MnO.CO_2$	47.56
Rhodonite (manganese pyroxene)	$MnO.SiO_2$	41.9
Tephroite (manganese olivine)	$2MnO.SiO_2$	54.3
Spessartite (manganese garnet)	$3MnO.Al_2O_3.3SiO_2$	33.3

These minerals occurring separately or combined among themselves or with other minerals form four different classes of materials from which manganese is obtained commercially: (1) manganese ores, (2) manganiferous iron ores, (3) manganiferous silver ores, and (4) manganiferous zinc residuum. Manganese ores consist of various mixtures of manganese oxides, sometimes containing admixtures of manganese carbonate.

Manganese ore.—Deposits of manganese ore occur in many parts of the United States, but are most abundant in the Appalachian and Piedmont regions, in the southern Mississippi Valley, and on the Pacific coast. Small deposits occur in the New England, Rocky Mountain, and Great Basin regions. The principal producing districts up to the present have been the James River-Staunton River, and the Blue Ridge regions in Virginia; the Cave Spring and Cartersville districts in Georgia; the Batesville district in Arkansas; and the Livermore-Tesla district in California. Of minor importance are the New River region in Virginia, the northeastern Tennessee region, the McCormick region in South Carolina, and the Little Grande district in Utah. At present mining and shipping is confined to the Blue Ridge and James River-Staunton River regions in Virginia.

Manganiferous iron ores.—Manganiferous iron ores consist of mixtures of manganese and iron oxides. Manganiferous iron ores occur in the United States chiefly in the New England, the Appalachian, and the Lake Superior regions, and minor deposits are found in the southern Mississippi Valley and in the Rocky Mountain region. High-grade manganiferous iron ore used for its manganese content occurs in the Appalachian region. Other manganiferous iron ores are produced in the Appalachian and the Lake Superior districts which are so low in manganese that they are classed as iron ores. In the blast furnace they yield a "high-manganese" pig iron, which is used for special purposes.

Manganiferous silver ores.—Manganiferous silver ores consist of mixtures of manganese and iron oxides with small quantities of silver sulphide and lead carbonate. As a rule, the iron content exceeds the manganese content, but locally the iron is altogether absent.

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[a] Notes by E. C. Harder, of the U. S. Geological Survey.

Manganiferous silver ores are divided into three classes, according to their uses. (1) The greater portion of the manganiferous silver ores are used for their silver and lead content. Manganese and iron content often insures those ores a higher price because of their fluxing value. (2) A second class of manganiferous silver ore is too low in silver and lead to be used as a source for these metals, but is sufficiently high in manganese and iron to be used for the manufacture of ferromanganese and spiegeleisen, as is the case with the high-grade manganiferous iron ores already mentioned. (3) There is a third class of manganiferous silver ore too low in silver and lead to be used primarily for these metals and too low in iron and manganese to be used for the manufacture of iron-manganese alloys. This ore is sold to the smelters as flux, the iron and manganese becoming waste products, while the silver and lead content is recovered during the smelting.

Manganiferous silver ores occur in the Rocky Mountain and Great Basin regions, the principal producing locality being Leadville, Colo. Some of the Leadville ores are used in the manufacture of spiegeleisen. All the other localities produce these ores for fluxing only.

Manganiferous zinc residuum.—Manganiferous zinc residuum is an artificial furnace product consisting of mixtures of manganese and iron oxides in a matrix of slag. Manganiferous zinc residuum is obtained from zinc volatilizing and oxidizing furnaces using New Jersey zinc ores. The residuum consists largely of iron and manganese oxides, the zinc having been removed by volatilization and collected as zinc oxide. The crude ores consist of franklinite, zincite, and willemite, and are obtained only from the Franklin Furnace district, New Jersey. Small quantities of zinc residuum are used annually in the manufacture of spiegeleisen.

USES OF MANGANESE.[a]

The principal use of manganese ores is in the manufacture of iron-manganese alloys such as spiegeleisen, ferromanganese, silverspiegel, and silicomanganese. The first two of these contain principally iron and manganese; the last two contain considerable silicon in addition. Ferromanganese and spiegeleisen are used in steel manufacture as reducers of iron oxide during the final melting, as recarburizers, and in the manufacture of special steels alone or in combination with chromium, nickel, tungsten, and other steel-hardening metals. Manganese is also used in the formation of alloys with copper, aluminum, zinc, tin, and other metals.

Manganese ores or manganiferous iron ores are used to a slight extent as fluxes in the reduction of silver, lead, and copper ores.

Manganese peroxide is used as an oxidizer in the manufacture of chlorine, bromine, and oxygen, and of potassium ferromanganate; as a drier in paints and varnishes; as a decolorizer of glass; and in the manufacture of the dry and the Leclanche cells. As a coloring material, manganese is used in coloring glass, bricks, and pottery. Several manganese salts are used in drying cloth and as paints.

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[a] Notes by E. C. Harder of the U. S. Geological Survey.

More complete discussions of the sources, uses, and occurrence of manganese ores were published in the statistical reports on manganese ores for 1907 and 1908,[a] and in a general report on manganese recently published by the Survey.[b]

MANGANESE-ORE INDUSTRY.

PRODUCTION.

Manganese ore.—The production of manganese ore in 1909 was 1,544 long tons, valued at $19,675, which was less than the production of any single year heretofore recorded. The greater part of the production in 1909 was from Virginia, minor quantities being shipped from California and Tennessee.

The following table shows the quantity, value, and average price per ton of the manganese ore produced in the different States in 1907, 1908, and 1909:

Production of manganese ore in the United States, 1907–1909, by States, in long tons.

State.	1907.			1908.			1909.		
	Quantity.	Value.	Average price per ton.	Quantity.	Value.	Average price per ton.	Quantity.	Value.	Average price per ton.
California	100	$600	$6.00				(a)	(a)	
South Carolina	800	4,800	6.00						
Tennessee	100	1,500	15.00				(a)	(a)	
Virginia	4,604	56,469	12.27	6,144	$62,779	$10.22	[b] 1,544	[b] $19,675	$12.74
Total	5,604	63,369	11.31	6,144	62,779	10.22	1,544	19,675	12.74

a Included with Virginia. b Includes production of California and Tennessee.

The following table shows the total production of manganese ore in the United States, by States, as compiled from previous volumes of Mineral Resources. The production prior to 1880 is only approximate, but probably did not exceed 50,000 long tons. The table shows Arkansas, Georgia, and Virginia as the principal producers, California as a fairly steady producer but only of small quantities, and the other States as producing small quantities of ore intermittently. The table also shows the periods of comparatively large production followed invariably by marked declines; but the present decline, which shows no indications of being followed by an immediate revival of production, is by far the most serious of all.

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[a] Harder, E. C. Manganese ores: Mineral Resources U. S. for 1907, U. S. Geol. Survey, 1908; Mineral Resources U. S. for 1908, U. S. Geol. Survey, 1909.

[b] Harder, E. C. Manganese deposits of the United States, with sections on foreign deposits, chemistry and uses: Bull. U. S. Geol. Survey No. 427, 1910.

Production of manganese ore in the United States, 1838–1909, in long tons.

Year.	Alabama.	Arkansas.	California.	Georgia.	Indian Territory, Michigan, Missouri, Montana, and Nevada.	North Carolina.
1838–1879	....	410	....	....	....	....
1866–1879	....	....	....	19,950	....	....
1867–1879	....	....	5,500	....	....	....
1880	....	....	....	1,800	....	....
1881	....	100	....	1,200	....	....
1882	....	175	....	1,000	....	....
1883	....	400	....	....	....	....
1884	....	800	....	....	....	....
1885	....	1,483	200	2,580	(Nev.) 200	....
1886	75	3,316	100	6,041	(Nev.) 30	14
1887	....	5,651	....	9,024	....	14
1888	....	4,312	1,500	5,568	(Mich.) 100	....
1889	....	2,528	53	5,208	(Nev.) 15	47
1890	....	5,339	386	749	(Nev.) 100	14
1891	....	1,650	705	3,575	(Ind. T.) 206	....
1892	....	6,708	....	826	....	....
1893	....	2,020	400	724	....	....
1894	....	1,934	278	1,277	....	....
1895	....	2,991	525	3,856	....	....
1896	....	3,421	284	4,085	....	2
1897	....	3,240	484	3,332	(Mich.) 37	....
1898	22	2,662	541	6,689	....	....
1899	....	356	115	3,089	(Mo.) 16	90
1900	....	145	131	3,447	(Mont.) 137	....
1901	17	91	610	4,074	(Mo.) 28	....
1902	....	82	846	3,500	....	....
1903	....	....	16	500	....	....
1904	....	....	60	....	....	....
1905	....	....	1	150	....	....
1906	....	62	1	....	....	....
1907	....	....	100	....	....	....
1908	....	....	....	....	....	....
1909	....	....	(a)	....	....	....
Total	114	49,876	12,836	92,244	869	181

a Included with Virginia.

Production of maganese ore in the United States, 1838–1909, in long tons—Continued.

Year.	Pennsylvania, South Carolina, and South Dakota.	Tennessee.	Utah and Vermont.	Virginia.	West Virginia and other States.	Total.
1838–1879						410
1866–1879						19,950
1867–1879				18,000		23,500
1880				3,661	300	5,761
1881				3,295	300	4,895
1882				2,982	375	4,532
1883				5,355	[a] 400	6,155
1884				8,980	[a] 400	10,180
1885				18,745	50	23,258
1886		50		20,567		30,193
1887				19,835		34,524
1888	(Pa.) 22			17,646	[b] 50	29,198
1889	(S. C.) 124	30	(Vt.) 1,576	14,616		24,197
1890				12,699		[c] 19,287
1891	(S. Dak.) 19		(Vt.) 49	16,248		[c] 22,452
1892				6,079		13,613
1893		482		4,092		7,718
1894		922		1,797	(W. Va.) 100	6,308
1895	(Pa.) 460			1,715		9,547
1896	(Pa.) 265			2,018	(W. Va.) 13	10,088
1897	(Pa.) 354	11		3,650		11,108
1898		381		5,662		15,957
1899	(Pa.) 12	19		6,228	(W. Va.) 10	9,935
1900		30		7,881		11,771
1901		400	(Utah) 2,500	4,275		11,995
1902	(S. C.) 8			3,041		7,477
1903	(S. C.) 25		(Utah) 483	1,801		2,825
1904			(Utah) 32	3,054		3,146
1905		20		3,947		4,118
1906		30	(Utah) 800	6,028		6,921
1907	(S. C.) 800	100		4,604		5,604
1908				6,144		6,144
1909		([d])		[e] 1,544		[e] 1,544
Total	2,089	2,475	5,440	236,189	1,998	404,311

[a] Georgia and North Carolina.

[b] Nevada, North Carolina, South Carolina, Tennessee, and Vermont.

[c] Colorado production of 1890 and 1891 published formerly as manganese is manganiferous ore and has been transferred to that table.

[d] Included with Virginia.

[e] Includes production of California and Tennessee.

Manganiferous ores.—The total production of manganiferous ores in the United States amounted to 843,689 long tons, as compared with 523,034 tons in 1908, an increase of 320,655 tons, or over 61 per cent. The Lake Superior region produced over 90 per cent of the total, but the percentage of manganese in the lake ore is low, and the ore was used simply as a source of high manganese pig iron. Of the manganiferous silver ore from Colorado, 12,905 tons, valued at $29,682, was used in the manufacture of spiegeleisen, and 52,119 tons, having a lower percentage of manganese than that used in the manufacture of spiegeleisen, was used for fluxing purposes. The manganiferous iron ore mined near Batesville, Ark., amounting to 3,235 tons, was also used as a flux.

The following table gives the quantity, value, average price per ton, and manganese content of the manganiferous ores used in the manufacture of spiegeleisen from 1906 to 1909, inclusive:

Production of Colorado manganiferous silver ores used in the manufacture of ferromanganese and spiegeleisen, 1906–1909, in long tons.

Year.	Percentage of manganese.	Quantity.	Value.	Average price per ton.
1906	26–36	32,400	$97,600	$3.01
1907	10–25	67,514	153,328	2.27
1908	22–26	15,973	39,468	2.47
1909	....	12,905	29,682	2.30
Total	....	128,792	320,078	2.49

The following table gives the quantity, value, average price per ton, and manganese content of the ores used for fluxing purposes, 1906 to 1909, inclusive, in Arkansas and Colorado:

Production of manganiferous ores used for fluxing or other purposes in Colorado and Arkansas, 1906–1909, in long tons.

Year.	State.	Percentage of manganese.	Quantity.	Value.	Average price per ton.
1906	Arkansas	20–25	8,900	$24,800	$2.79
1907	Arkansas	14	4,133	8,266	2.00
	Colorado	8–26	32,197	[a] 97,879	3.04
1908	Arkansas	14	4,066	9,149	2.25
	Colorado	6–22	35,581	83,939	2.36
1909	Arkansas	28	3,325	5,819	1.75
	Colorado	....	52,119	179,813	3.45
Total	....	....	140,321	409,665	2.92

[a] Partly estimated.

The following table gives the total production of all kinds of manganiferous ores in the United States so far as records are available. The disposition of the western ores has been already mentioned. All the eastern ore was presumably used in the manufacture of iron-manganese alloys:

Production of manganiferous ores in the United States, 1885–1909, in long tons.

Year.	Arkansas.	Colorado.[a]	Colorado.[b]	Lake Superior region.	Virginia.	Other States.	Total.
1885						(Mont.) [b] 4,263	4,263
1886			[c] 60,000	257,000			317,000
1887			[c] 60,000	210,000	1,025	[d] 726	271,751
1888			[c] 60,000	201,036		[e] 1,096	262,132
1889			64,987	81,359			146,346
1890		[f] 6,397	51,840	61,863			120,100
1891		[f] 964	79,511	132,511			212,986
1892		2,942	62,309	147,431	3,000		215,682
1893	160	5,766	55,962	110,648	1,188	(N. C.) 20	173,744
1894		7,022	31,687	198,466			237,175
1895		13,464	54,163	112,265			179,892
1896		9,072	138,079	329,640			476,791
1897		16,519	149,502	184,585		(Vt.) 1,200	351,806
1898		18,848	99,651	268,862		(Pa.) 100	387.461
1899		29,355	79,855	732,490			841,700
1900		43,303	188,509	334,274			566,086
1901		62,385	228,187	512,084		(N. C.) 20	802,676
1902		13,275	194,132	884,939	3,000		1,095,346
1903		14,856	179,205	566,835	2,802		763,698
1904	600	17,074	105,278	365,572			488,524
1905	3,321	45,837	81,738	720,098			850,994
1906	8,900	32,400	([g])	[h] 1,000,000			[h] 1,041,300
1907	4,133	67,514	32,197	314,316		(N. M.) 7,000	425,160
1908	4,066	15,973	35,581	467.140	274		523,034
1909	3,325	12,905	52,119	775,035	305		843,689
Total	24,505	435,871	2,144,492	8,968,449	11,594	14,425	11,599,336

[a] Manganiferous silver ore used in the manufacture of spiegeleisen and ferromanganese.

[b] Manganiferous silver ore used for flux; mainly from Colorado, but in a few cases probably including other Western States.

[c] Contains some Montana ore.

[d] Georgia 195 tons, Maine 50 tons, and Vermont 481 tons.

[e] North Carolina, South Carolina, and Tennessee 96 tons, and Vermont 1,000 tons.

[f] Published as manganese ore in previous volumes of Mineral Resources.

[g] Not recorded.

[h] Estimated.

Manganiferous zinc residuum.—The material classed under this head is a residual product from certain zinc oxide works using New Jersey zinc ores. The crude ore consists of a mixture of franklinite, zincite, and willemite, the first being predominant. During roasting the bulk of the zinc is removed as zinc oxide, and the residuum consists of a mass of manganese and iron oxides. This residuum is used for the manufacture of spiegeleisen and ferromanganese. The following table shows the quantity, value, and average price per ton of manganiferous zinc residuum produced from 1905 to 1909, inclusive:

Production of manganiferous zinc residuum in the United States, 1905–1909, in long tons.

Year.	Quantity.	Value.	Average price per ton.
1905	90,289	$90,289	$1.00
1906	93,461	93,461	1.00
1907	93,413	280,239	3.00
1908	110,225	330,675	3.00
1909	141,264	423,792	3.00
Total	528,652	1,218,456	2.30

The following table gives the production of manganiferous zinc residuum in the United States as far as has been recorded:

Production of manganiferous residuum from zinc roasting in the United States, 1889-1909, in long tons.[a]

Year	Tons	Year	Tons
1889	43,648	1901	52,311
1890	48,560	1902	65,246
1891	38,228	1903	73,264
1892	31,859	1904	68,189
1893	37,512	1905	90,289
1894	26,981	1906	93,461
1895	43,249	1907	93,413
1896	44,935	1908	110,225
1897	33,924	1909	141,264
1898	48,502		
1899	65,010	Total	1,337,180
1900	87,110		

PRICES OF ORE.

The prices of manganese ore used in the steel industry vary from $5 to $15 per long ton, according to the grade of the ore. They are governed by the following schedule of prices established by the Carnegie Steel Company:[b]

Schedule of prices paid per ton of 2,240 pounds for domestic manganese ore delivered at Pittsburg or Bessemer, Pa., and South Chicago, Ill.

Prices are based on ores containing not more than 8 per cent silica or 0.20 per cent phosphorus, and are subject to deductions as follows: For each 1 per cent in excess of 8 per cent silica there shall be deduction of 15 cents per ton; fractions in proportion.

For each 0.02 per cent, or fraction thereof, in excess of 0.20 per cent phosphorus there shall be a deduction of 2 cents per unit of manganese per ton.

Percentage of metallic manganese in ore.	Price per unit in cents.	
	Manganese.	Iron.
Over 49	26	5
46 to 49	25	5
43 to 46	24	5
40 to 43	23	5

Ores containing less than 40 per cent manganese or more than 12 per cent silica or 0.225 per cent phosphorus are subject to acceptance or refusal at the buyer's option.

Settlements are based on analysis of sample dried at 212° F., the percentage of moisture in the sample as taken being deducted from the weight.

The manganese ores for oxidizing and coloring purposes are valued according to the quantity of manganese peroxide present, their consistency, etc., and prices range up to $35 per ton for the better grades of ore. Manganiferous ores used in steel manufacture and for fluxing range in price from $2 per ton upward.

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[a] The manufacture of spiegeleisen from manganiferous residuum was begun in 1870, but there is no record of the tonnage of raw material used prior to 1889.

[b] Prices of manganese ore: Eng. and Min. Jour. March 5, 1910.

IMPORTS.

The imports of manganese ore into the United States in 1909 amounted to 212,765 long tons, valued at $1,405,329, as compared with 178,203 tons, valued at $1,350,223, imported in 1908, an increase in quantity of 34,562 tons and in value of $55,106. Although the total of imports for 1909 was not so great as was reached in certain years during the last decade, yet the quantity imported bears a higher ratio to the quantity produced in the United States than in any other year, so far as has been recorded. As is shown in the table, the principal importing countries are Brazil and British India, with important quantities imported from Russia and France.

The following tables, compiled from data furnished by the Bureau of Statistics, Department of Commerce and Labor, show the imports of manganese ore into the United States from different countries and by ports of entry for 1907, 1908, and 1909:

Imports of manganese ore into the United States, 1907–1909, by countries, in long tons.

Country.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Brazil	52,922	$522,510	17,150	$163,561	35,600	$323,743
Russia	1,000	19,570	250	4,599	14,486	95,658
British India	95,300	552,228	143,813	912,646	145,140	735,967
Cuba	30,006	262,847	1,469	13,489	2,950	11,800
Other East Indies	12,552	82,832	7	170	....	....
France	1,588	31,536	5,546	75,857	5,974	79,093
Netherlands	1,795	35,473	761	11,265	1,074	11,037
Japan	1,787	15,020	3,336	41,930	1,272	17,739
Germany	6,702	150,388	2,620	62,045	2,613	57,916
United Kingdom	3,999	96,833	2,973	59,092	1,385	40,525
Canada	16	500	73	1,245	766	9,234
Spain	....	....	....	24	....	....
Belgium	1,354	23,406	202	4,214	1,505	22,617
All other countries	....	....	3	86	....	....
Total	209,021	1,793,143	178,203	1,350,223	212,765	1,405,329

Manganese ore imported into the United States, 1907–1909, by customs districts, in long tons.

Customs districts.	1907.		1908.		1909.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Philadelphia, Pa	106,494	$888,239	68,491	$504,094	62,717	$381,730
Baltimore, Md	92,331	694,732	103,043	724,913	143,122	891,758
New York, N. Y	7,867	177,323	5,963	105,665	5,146	98,762
Chicago, Ill	266	11,839	....	....	....	....
Boston, Mass	....	....	5	280	52	1,041
New Orleans, La	1,949	16,539	232	2,752	....	....
All others	114	4,471	469	12,519	1,728	32,038
Total	209,021	1,793,143	178,203	1,350,223	212,765	1,405,329

The following table shows the total quantity of manganese ore imported into the United States, as far as has been recorded. The figures from 1868 to 1888 represent imports from Canada only; those from 1889 to the present time represent total imports.

Imports of manganese ore into the United States, 1868–1909, in long tons.

Year ending—	Quantity.	Year ending—	Quantity.
June 30—		December 31—Continued.	
1868	1,017	1889[a]	4,286
1869	488	1890	34,154
1870	1,402	1891	28,825
1871	1,056	1892	58,572
1872	1,206	1893	68,113
1873	838	1894	44,655
December 31—		1895	86,111
1873	1,031	1896	31,489
1874	782	1897	119,961
1875	203	1898	114,885
1876	412	1899	188,349
1877	891	1900	256,252
1878	626	1901	165,722
1879	1,886	1902	235,576
1880	2,179	1903	146,056
1881	1,704	1904	108,519
1882	894	1905	257,033
1883	1,326	1906	221,260
1884	603	1907	209,021
1885	1,684	1908	178,203
1886	1,818	1909	212,765
1887	1,630		
1888	1,182	Total	[b] 2,794,665

[a] Figures prior to 1889 represent imports from Canada only, total importations from other countries for these years not being obtainable.

[b] This total duplicates the importation from January 1 to June 30, 1873.

WORLD'S PRODUCTION.

The following table gives the latest available statistics with regard to the world's production of manganese ore. The unit is the metric ton for all countries except the United States, whose production is given in long tons.

World's production of manganese ore.

Country.	Year.	Quantity.	Country.	Year.	Quantity.
		Tons.			*Tons.*
North America:			Europe—Continued.		
United States	1909	1,544	United Kingdom	1908	6,409
South America:			Russia	1907	1,003,528
Brazil [a]	1908	166,122	Spain	1908	16,945
Chile	1908	1	Sweden	1908	4,616
Europe:			Turkey	[b] 1908	14,349
Austria	1908	16,656	Norway	1904	22
Bosnia and Herzegovina	1908	6,900	Asia:		
Hungary	1908	10,676	India	1908	685,136
France	1908	15,865	Japan	1908	11,130
German Empire	1908	67,692	Java	1908	1,200
Greece	1908	10,750	Oceania:		
Italy	1908	2,750	Queensland	1908	1,403

[a] Exports.

[b] Year ending March, 1908.

FERROMANGANESE AND SPIEGELEISEN.

PRODUCTION.

The total production of ferromanganese and spiegeleisen in the United States in 1909 was 225,040 long tons, of which 82,209 tons were ferromanganese and 142,831 tons were spiegeleisen. As compared with the production in 1908 of ferromanganese, which was 40,642 tons, and of spiegeleisen, which was 111,376 tons, the production of 1909 represents a gain of 41,567 tons and 31,455 tons, respectively, or about 48 per cent over the total for 1908. The output of these materials in 1909 was from Pennsylvania and Illinois.

Production of spiegeleisen and ferromanganese in the United States, 1872–1909, in long tons.

1872	4,072	1892	179,131
1873	3,930	1893	81,118
1874	4,070	1894	120,180
1875	6,993	1895	171,724
1876	5,907	1896	131,940
1877	7,897	1897	173,695
1878	9,530	1898	213,769
1879	12,438	1899	219,768
1880	17,503	1900	255,977
1881	18,827	1901	291,461
1882	19,610	1902	212,934
1883	21,941	1903	192,661
1884	30,262	1904	219,446
1885	30,956	1905	289,983
1886	42,841	1906	300,500
1887	42,498	1907	339,348
1888	48,901	1908	152,018
1889	76,628	1909	225,040
1890	133,180		
1891	127,766	Total	4,436,443

PRICES.

The prices of iron-manganese alloys vary with the content of these metals. However, as the alloys are generally made with a fairly definite composition, the prices vary only within small limits.

The following table shows the average range of prices for various iron-manganese alloys during 1909:

Prices per long ton of iron-manganese alloys during 1909.

Alloy.	Approximate percentage of manganese and silicon.	Price.
Ferromanganese[a]	75–80 Mn	$41.95–$48.45
Spiegeleisen[a]	15–20 Mn	25.50– 32.00
Silicomanganese	70–75 Mn 20–25 Si	
Silicospiegel[a]	15–20 Mn 10–12 Si	25.00– 36.00

[a] Compiled from weekly tables in the Industrial World, Pittsburg.

IMPORTS.

Important and steadily increasing quantities of iron-manganese alloys are imported into the United States annually. The following table gives the quantity and value of ferromanganese and spiegeleisen imported into the United States from 1903 to 1909, inclusive:

Ferromanganese and spiegeleisen imported and entered for consumption, 1903–1909, in long tons.

Year.	Ferromanganese.		Spiegeleisen.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
1903	41,519	$1,699,666	122,015	$2,709,317	163,534	$4,408,983
1904	21,813	707,037	4,623	132,461	26,436	839,498
1905	52,841	1,884,651	55,457	1,336,104	108,298	3,220,755
1906	84,359	4,953,644	103,268	2,942,940	187,627	7,896,584
1907	87,400	5,354,656	48,994	1,399,381	136,394	6,754,037
1908	44,624	1,860,664	4,579	125,054	49,203	1,985,718
1909	88,934	3,396,381	16,921	356,447	105,855	3,752,828

The following table gives the quantity of ferromanganese and spiegeleisen imported by fiscal years so far as has been recorded:

Imports of ferromanganese and spiegeleisen into the United States during fiscal years ending June 30, 1884–1909, in long tons.[a]

Year ending June 30—	Ferromanganese.	Spiegeleisen.	Total.
1884	94,210		94,210
1885	65,406		65,406
1886	99,426		99,426
1887	150,205		150,205
1888	108,973		108,973
1889	93,032		93,032
1890	108,771		108,771
1891	54,239		54,239
1892	55,080		55,080
1893	49,157		49,157
1894	11,579		11,579
1895	8,127		8,127
1896	66,608		66,608
1897	11,301		11,301
1898	6,346	10,108	16,454
1899	10,392	3,615	14,007
1900	10,684	13,675	24,359
1901	8,995	16,308	25,303
1902	37,618	31,416	69,034
1903	53,121	122,566	175,687
1904	23,903	50,620	74,523
1905	41,166	22,443	63,609
1906	62,064	88,224	150,288
1907	94,543	82,423	176,966
1908	58,101	18,504	76,605
1909	64,107	3,594	67,701
Total			1,910,650

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[a] Imports prior to 1884 not recorded. Estimated quantity imported yearly during the seventies is about 20,000 to 30,000 tons.

GOLD AND SILVER.

By H. D. McCaskey.[a]

INTRODUCTION.

This report gives final figures for the production of gold and silver in the United States, together with a presentation of the relative classes and quantities of ores producing the metals and a summary review of the gold and silver industries, for the calendar year 1909. The report has been greatly delayed owing to cooperation with the Bureau of the Census in obtaining statistics for 1909, the detailed nature of the inquiries of that bureau necessitating personal visits by special agents to mines and plants whose figures are ordinarily obtained by the United States Geological Survey by correspondence with the operators.

To the many thousands of mining and metallurgical men throughout the United States and Alaska who have cooperated with the United States Geological Survey in furnishing information for the mine reports on the metal production thanks are heartily given. Their interest and spirit, as shown by the considerable time and trouble they have often taken to fill out the Survey inquiries in detail, have been extremely gratifying. It is hoped to make the results of the reports as useful as possible to them in return.

PRODUCTION.

The production of gold and silver in the United States from domestic ores in 1909 is shown in the following table in distribution by States and Territories:

Approximate distribution by producing States and Territories of the product of gold and silver in the United States for the calendar year 1909, in fine ounces.[b]

State or Territory.	Gold.		Silver.	
	Quantity.	Value.	Quantity.	Commercial value.
Alabama	1,413	$29,200	200	$100
Alaska	983,928	20,339,600	198,600	103,300
Arizona	127,071	2,626,800	2,523,600	1,312,300
California	1,001,537	20,703,600	2,304,900	1,198,500
Colorado	1,056,829	21,846,600	8,846,300	4,600,100
Georgia	2,099	43,400	200	100
Idaho	65,026	1,344,200	6,755,900	3,513,100
Illinois			900	500
Michigan			217,600	113,100
Missouri	10	200	15,200	7,900

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[a] Valuable aid has been rendered by J. P. Dunlop in the preparation of the majority of the tables of this eport, and in verification of all of the figures.

[b] Gold value, $20.671834625323 per fine ounce. Average commercial silver value in 1909, 52 cents per fine ounce.

Approximate distribution by producing States and Territories of the product of gold and silver in the United States for the calendar year 1909, in fine ounces—Continued.

State or Territory.	Gold.		Silver.	
	Quantity.	Value.	Quantity.	Commercial value.
Montana	181,411	$3,750,100	12,034,500	$6,257,900
Nevada	792,682	16,386,200	10,119,200	5,262,000
New Hampshire			3,000	1,600
New Mexico	12,229	252,800	324,200	168,600
North Carolina	1,519	31,400	400	200
Oregon	40,103	829,000	69,600	36,200
Pennsylvania	300	6,200		
Philippine Islands	11,978	247,600	3,000	1,600
Porto Rico	29	600		
South Carolina	358	7,400		
South Dakota	317,998	6,573,600	196,300	102,100
Tennessee	208	4,300	65,300	33,900
Texas	19	400	408,100	212,200
Utah	203,818	4,213,300	10,551,100	5,486,600
Virginia	194	4,000	6,400	3,300
Washington	20,753	429,000	75,200	39,100
Wyoming	189	3,900	1,800	900
Total	4,821,701	99,673,400	54,721,500	28,455,200

The figures in this table are also those of the Director of the Mint. They result from cooperation of the Bureau of the Mint and the United States Geological Survey and are agreed upon after conference and adjustment between the two bureaus. They are therefore final for both.

The data used for this table are based on bullion deposits in the United States mints and assay offices and returns to the Bureau of the Mint from the smelting and refining companies. The distribution is checked and verified by information collected by the United States Geological Survey direct from the producing mines and tabulated for the mine reports later discussed. The data giving the total production, and in part the distribution, are obtained from records of: (1) The unrefined domestic gold and silver deposited in United States mints and assay offices; (2) the domestic gold and silver in fine bars reported by private refineries; and (3) the unrefined domestic gold and silver contained in ores, copper matte, etc., exported for reduction. The last item is of small relative importance.

In addition to production of gold and silver from domestic sources in 1909, the smelters and refineries produced from foreign ore, matte, and unrefined bullion, 965,007 fine ounces of gold, valued at $19,948,465, and 71,882,005 fine ounces of silver, valued at $37,378,643. Of this foreign gold nearly $9,000,000 may be credited to Canada, about $8,250,000 to Mexico, about $1,000,000 to Central America, principally to Salvador and Honduras, about $400,000 to South America, principally to Bolivia and Peru, and about $200,000 to the Orient, mainly to Australia. Of the foreign silver nearly 42,000,000 fine ounces may be credited to Mexico, over 20,250,000 ounces to Canada, chiefly to Cobalt, nearly 4,000,000 ounces to South America, and about 1,500,000 ounces to Central America, while a third of a million came from the Orient and a quarter of a million from Europe.

Gains and losses in the production of gold and silver in the various States and Territories, as compared with the output of 1908, are shown in the following table:

Increase (+) *or decrease* (−) *in production of precious metals in the United States in 1909, by States and Territories, in fine ounces.*

State or Territory.	Gold.		Silver.	
	Quantity.	Value.	Quantity.	Commercial value.
Alabama	− 580	− $12,000	− 200	− $100
Alaska	+ 23,259	+ 480,800	− 6,000	− 6,100
Arizona	+ 6,134	+ 126,800	− 376,400	−238,900
California	+ 66,463	+1,373,900	+ 601,200	+287,200
Colorado	− 49,555	−1,024,400	−1,303,900	−829,300
Georgia	− 620	− 12,800		
Idaho	− 4,803	− 99,300	− 802,400	−529,800
Illinois			− 1,100	− 600
Michigan			− 76,569	− 44,200
Missouri	+ 10	+ 200	− 34,200	− 18,500
Montana	+ 28,546	+ 590,100	+1,678,300	+718,400
Nevada	+227,207	+4,696,800	+ 610,700	+175,900
New Hampshire	− 179	− 3,700	− 3,300	− 1,800
New Mexico	− 2,588	− 53,500	− 76,700	− 45,900
North Carolina	− 3,197	− 66,100	− 900	− 500
Oregon	− 3,720	− 76,900	+ 13,500	+ 6,200
Pennsylvania	+ 300	+ 6,200		
Philippine Islands	− 1,785	− 36,900	+ 1,700	+ 900
South Carolina	− 2,240	− 46,300	− 200	− 100
South Dakota	− 56,531	−1,168,600	− 1,000	− 3,400
Tennessee	+ 29	+ 600	+ 4,400	+ 1,300
Texas	− 5	− 100	− 38,900	− 26,900
Utah	+ 12,896	+ 266,600	+2,099,800	+966,000
Virginia	+ 20	+ 400	+ 6,100	+ 3,100
Washington	+ 8,480	+ 75,300	− 11,600	− 7,300
Wyoming	− 179	− 3,700	− 1,700	− 1,000
Total	+247,361	+5,113,400	+2,280,700	+404,600

Gold.—The total production of gold in the United States in 1909 was 4,821,701 fine ounces, valued at $99,673,400. Compared with the production of 1908 this was an increase of 247,361 ounces, or $5,113,400. It was also the largest output of gold in the history of the country.

Twenty-two States and Territories contributed to the production of gold in 1909 and the Philippine Islands and Porto Rico added to the output. Of these 24 geographic divisions, increased production was recorded from 11 and decreased output from 13. The greatest gains were as follows: Nevada, $4,696,800; California, $1,373,900; Montana, $590,100; Alaska, $480,800; Utah, $266,600; and Arizona, $126,800. A heavy decrease of $1,168,600 was shown from South Dakota and another of $1,024,400 from Colorado. In no other State did the production decrease $100,000.

The gold-mining industry was again generally prosperous in 1909. The production would have been considerably over $100,000,000 but for certain abnormal conditions preventing operations for the entire twelve months of the year at the Homestake mines in the Black Hills, and for reduced mining in the Cripple Creek district pending the completion of the deep drainage tunnel. Although production from the great Goldfield district was from a smaller number of mines than originally expected, the output has been great and on the increase. Elsewhere, in many Nevada camps especially, development and exploration have been vigorous, and prospecting has been active throughout most of the West, adding some new camps. The dredging industry continued prosperous in general, especially in California. A normal annual production of about $100,000,000 in gold from the United States, Alaska, and the Philippines may reasonably be expected, although present conditions do not indicate an output in considerable excess of this amount.

Silver.—The production of silver from domestic ores in 1909 was 54,721,500 fine ounces, with a commercial value of $28,455,200. This represents an increase in quantity of 2,280,700 fine ounces and in value of $404,600 over the output for 1908.

Twenty-three States and Territories supplied the production of silver for 1909, and a nominal quantity was derived from refining gold bullion produced in the Philippines. Of these States an increased output for 1909 was shown from only 8, and decreases are indicated for the remaining 16. The largest gain was from Utah, whose production increased 2,099,800 ounces, mainly from lead ores; the next most important increase was of 1,678,300 ounces from Montana, from augmented copper production; the production of Nevada increased by 610,700 fine ounces, mainly from lead ores, but also from increase of siliceous ores; and California increased her output 601,200 ounces from copper ores. The most notable decrease in silver production was from Colorado, where the output declined by 1,303,900 ounces, mainly from copper ores, but also from dry or siliceous and mixed ores; there was a decrease of 802,400 ounces noted from Idaho from all classes of ore; and a decrease of 376,400 ounces from Arizona from dry or siliceous ores. In each of the other States increased or decreased production for 1909 was under 100,000 ounces, and in 11 of them the changes were not 10,000 ounces either way.

The silver-mining industry as such is relatively small under present mining conditions in the United States, only 36 per cent of the silver production being derived from precious-metal ores in 1909, and only a small portion of this being from those classed primarily as silver ores. The great bulk of the silver production is from the refining of gold, copper, and lead from gold-silver ores, copper ores, and lead ores. The prosperity of the copper and lead mining and smelting industries is, therefore, a large factor. With better prices for silver the mining of silver-lead ores would largely increase. Undoubtedly the price of silver is of great importance in western mining especially, being the final factor often in the decision whether a mine can be worked at a profit or not. As 1909 was a fairly good year for both copper and lead industries, silver production from copper and lead ores increased largely.

The average monthly price of silver in New York in 1909 showed remarkably little fluctuation, never falling to 50 cents nor rising to 53 cents, the average New York price for the year being 52 cents. Undoubtedly heavy production from Canada and Mexico kept down the market price, and there is little present indication of decrease in output from either country. On the other hand, the Canadian production, mostly from Cobalt, is on the increase. The output from Canada in 1909 was 27,529,473 fine ounces and that of Mexico about 73,000,000 ounces. The production of Mexico showed no material increase over that of 1908, but that of Canada increased nearly 6,000,000 ounces.

In the world's production of silver Mexico leads, with about one-third of the total to her credit, followed by the United States with one-fourth of the total and by Canada with about one-eighth. The total increase in world's output for 1909 was only about 5,000,000 ounces—or approximately the increase from Canada, as other producing countries maintained an even output, or, like Australasia, suffered a decline. Demand continues to be mainly from India and

China, although it is increasing in the arts—as, for instance, in photography.

The average New York commercial value of silver since 1900 has been as follows: 1900, $0.62; 1901, $0.60; 1902, $0.53; 1903, $0.54; 1904, $0.58; 1905, $0.61; 1906, $0.68; 1907, $0.66; 1908, $0.53; and 1909, $0.52.

PRODUCTION OF GOLD AND SILVER IN THE UNITED STATES SINCE 1792.

According to tables published by the Director of the Mint, the total production of gold and silver in the United States from 1792 to 1909, inclusive, is as follows:

Production of gold and silver in the United States, 1792–1909, by periods, in fine ounces.

[The estimate for 1792–1872 is by R. W. Raymond, commissioner, and since by the Director of the Mint.]

Years.	Gold.		Silver.	
	Quantity.	Value.	Quantity.	Commercial value.
1792–1847	1,187,170	$24,537,000	309,500	$404,500
1848–1872	58,279,778	1,204,750,000	118,568.200	157,749,900
1873–1909	93,654,932	1,936,017,400	1,718,992,800	1,408,347,400
Total	153,121,880	3,165,304,400	1,837,870,500	1,566,501,800

The following table, from the report of the Director of the Mint on the production of gold and silver, shows the quantity and value of these metals produced in the United States since 1880:

Production of gold and silver in the United States from 1880 to 1909, inclusive, in fine ounces.

Year.	Gold.		Silver.	
	Quantity.	Value.	Quantity.	Commercial value.
1880	1,741,500	$36,000,000	30,318,700	$34,717,000
1881	1,678,612	34,700,000	33,257,800	37,657,500
1882	1,572,187	32,500,000	36,196,900	41,105,900
1883	1,451,250	30,000,000	35,732,800	39,618,400
1884	1,489,950	30,800,000	37,743,800	41,921,300
1885	1,538,373	31,801,000	39,909,400	42,503,500
1886	1,686,788	34,869,000	39,694,000	39,482,400
1887	1,603,049	33,136,000	41,721,600	40,887,200
1888	1,604,478	33,167,500	45,792,700	43,045,100
1889	1,594,775	32,967,000	50,094,500	46,838,400
1890	1,588,877	32,845,000	54,516,300	57,242,100
1891	1,604,840	33,175,000	58,330,000	57,630,000
1892	1,597,098	33,015,000	63,500,000	55,662,500
1893	1,739,323	35,955,000	60,000,000	46,800,000
1894	1,910,813	39,500,000	49,500,000	31,422,100
1895	2,254,760	46,610,000	55,727,000	36,445,500
1896	2,568,132	53,088,000	58,834,800	39,654,600
1897	2,774,935	57,363,000	53,860,000	32,316,000
1898	3,118,398	64,463,000	54,438,000	32,118,400
1899	3,437,210	71,053,400	54,764,500	32,858,700
1900	3,829,897	79,171,000	57,647,000	35,741,100
1901	3,805,500	78,666,700	55,214,000	33,128,400
1902	3,870,000	80,000.000	55,500,000	29,415,000
1903	3,560,000	73,591,700	54,300,000	29,322.000
1904	3,892,480	80,464,700	57,682,800	33,456.000
1905	4,265,742	88,180,700	56,101,600	34,222.000
1906	4,565,333	94,373,800	56,517,900	38,256,400
1907	4,374,827	90,435,700	56,514,700	37,299,700
1908	4,574,340	94,560,000	52,440,800	28,050,600
1909	4,821,701	99,673,400	54,721,500	28,455,200
Total	80,115,168	1,656,125,600	1,510,573,100	1,157,273,000

IMPORTS AND EXPORTS.

The following table gives a summary of imports and exports of gold and silver during 1909:

Imports and exports of gold and silver during the calendar year 1909.

[Figures furnished by the Bureau of Statistics.]

Description.	Imports.	Exports.	Excess of—	
			Imports.	Exports.
GOLD.				
Contained in domestic ore and base bullion		$540,211		$540,211
Contained in foreign ore and base bullion	$13,438,819		$13,438,819	
Domestic bullion, refined		40,720,027		40,720,027
Foreign bullion, refined	24,934,037	160	24,933,877	
United States coin	2,530,224	88,885,457		86,355,233
Foreign coin	3,183,886	2,734,966	448,920	
Total	44,086,966	132,880,821	38,821,616	127,615,471
Excess of exports				88,793,855
SILVER.				
Contained in domestic ore and base bullion		653,537		653,537
Contained in foreign ore and base bullion	30,458,946	62,480	30,396,466	
Domestic bullion, refined		54,951,327		54,951,327
Foreign bullion, refined	12,672,497	1,152,026	11,520,471	
United States coin	2,309,827	202,369	2,107,458	
Foreign coin	746,432	570,570	175,862	
Total	46,187,702	57,592,309	44,200,257	55,604,864
Excess of exports				11,404,607

The imports came from many countries in Central and South America, from Japan and Australia, and even from Europe, but the great bulk of the imported gold and silver came from Mexico and Canada.

In 1909, according to the Bureau of Statistics, Mexico sent to this country gold valued at $7,587,090 in ore and base bullion and at $14,015,453 in refined bullion—a total value in gold of $21,602,543; and silver valued at $17,926,986 in ore and base bullion and $9,823,580 in refined bullion—a total value in silver of $27,750,566.

During the same year Nova Scotia, New Brunswick, and Prince Edward Island sent to this country gold valued at $58,122 in ore and base bullion and at $68,122 in refined bullion; Quebec, Ontario, Manitoba, etc., sent gold valued at $198,905 in ore and base bullion and at $3,867,839 in refined bullion, and silver valued at $9,929,401 in ore and base bullion and at $507,884 in refined metal; and British Columbia sent gold valued at $4,213,139 in ore and base bullion and at $1,364,749 in refined bullion, and silver valued at $650,148 in ore and base bullion. The total imports from Canada were gold valued at $9,770,876 and silver valued at $11,087,433.

MINES REPORT.

METHOD OF COLLECTING STATISTICS.

The first table given in this report presents the figures of production of gold and silver accepted as final by the Geological Survey, as, with the relatively unimportant exceptions of domestic gold and silver in ores, mattes, etc., exported for reduction during the year, they record the actual production of gold and silver bullion in marketable form as metals, either refined or unrefined. Owing to the impossibility of tracing this bullion back to its origin by States, counties, and mining districts, the Geological Survey attacks the problem of distribution by systematic investigation of the production of ores containing gold and silver during the calendar year, by mines and by placer output. In this way the state of the mining industry is studied in detail, and classification of output by methods of production and classes of ore by mining districts is obtained. The resulting figures form the basis of the mines report.

As already stated, the Bureau of the Mint takes into account, as the basis for statistics of production, the gold and silver in gold bullion deposited in the United States mints and assay offices, in fine bars of both metals reported by private refineries, and in ores, mattes, etc., exported for reduction.

The data for the Geological Survey mines report on the output of gold and silver may be classified as follows: (1) Gold and silver in placer nuggets, dust, and bullion; (2) gold and silver in mill bullion from mills of mine companies treating their own ores; (3) gold and silver in base bullion, matte, etc. (by assay value), from smelters of mine companies treating their own ores; (4) gold and silver in crude ore and concentrates (by assay value) shipped to custom mills and smelters—all four of these items being for gravel washed, or ore sold or treated, during the calendar year.

The first item is the simple case of native metal recovered and sold to government mints, assay offices, refineries, banks, and traders. It is not difficult to obtain accurate figures for this except in some parts of Alaska, or in the cases of transitory miners elsewhere, or when miners report value received for bullion only—for all of which cases, however, Survey estimates are found to be usually close. The second and third items cover metal production by mining companies whose mills and smelters treat their own ores and whose products go to the mints and refineries and are covered by confidential mine reports to the Survey. The fourth item, which covers raw products of the mine shipped for treatment, gives rise to the main apparent discrepancies between mine and mint-refinery reports on the production of precious metals for the same calendar year. This is readily understood from the fact that the interval of time between the disposal by shipment of ore as reported from the mines and the arrival and metallurgical treatment of it at the mills or smelters, followed by the refining of the products of the same ore, means annually that large quantities of metals in ores reported from the mines as shipped in one year will be reported by refineries as produced in the following year. The miners furnish the Geological Survey with confidential reports on assay values and tonnages of ores and concentrates shipped as the measure of their output and the smelters and refineries report the metals eventually produced in both their unrefined and refined state.

In using this mines report it should be remembered that tonnages and production given are not for ore mined, but for ore that is sold or treated during the calendar year. Of course most of the ore sold or treated is also mined during the same year, but some of it is necessarily mined during the preceding year. It must not be overlooked, also, that the mines report is not based on the assay value of the total tonnage, but aims to give, as far as possible, the metal recovery from the tonnage sold or treated during the calendar year. A part of the actual recovery is of course made during the early part of the following year in the case of ores sold or treated late in the year under review; but the basis of the report is essentially metal recovered at whatever time from tonnage sold or treated during the year covered by the report. For items 2 and 3, above, the recovery figures are easily had, as the ore is treated on the ground and the metal content of the bullion, either base or unrefined, is readily known. In item 3 the refining loss and in item 4 the combined smelting and refining losses must be taken into account, but in the cases of the precious metals these are known to be very small and in actual practice to be more than offset by certain gains. These gains are of small quantities of precious metals, not paid for but actually recovered from ores of copper, lead, and zinc, and certain differences in quantities of gold and silver between actual recovery and basis of settlement, silver being paid for on the basis of 95 per cent of the current New York price and gold at from $19 to $20 per ounce. From this it is seen that small producers, frequently reporting in terms of dollars, will be giving figures below actual final production of metal, and if they erroneously report net proceeds, as they sometimes do, their figures are still further below. Other gains, offsetting refining and smelting losses, are the relatively small amounts of precious metals, principally gold, not regularly reported from the mines, but coming from transitory placer mines whose production escapes estimates; from stolen ore treated in improvised "assay offices;" and from smelter and refinery cleanings and similar material. Although mine reports in the aggregate may appear to give figures of gold and silver production too high, therefore, it is known from actual practice that final recoveries are somewhat in excess of those estimated from tonnages of the mines.

COMPARISON OF MINT REPORT AND MINES REPORT.

Of the two plans outlined above for ascertaining the gold and silver production of the United States it may be said that the one is a measure more directly of the mining industry, the other of the results of the metallurgical side. The two methods will not produce exactly corresponding results nor should they be expected to do so. The calendar year covered by both investigations is the same, but the period of mine production naturally corresponds to a period earlier by the time necessary for transporting, sampling, and treating the ore and refining the products than the period covered by actual production of marketable metal. This period is practically negligible in the case of placer and mill bullion, but may be several months in the case of smelting ores. In this connection it may be stated that forthcoming reports of the Bureau of the Census for the metal production of 1909 may be expected to show divergence of results for still another period, as the census returns are accepted for the fiscal years of the operating companies which in many cases do not coincide with calendar years.

The figures obtained for the mint and the mines reports should agree, within certain limits of error due to the complex nature of the inquiries especially for mine production, for a period of years sufficiently long to compensate for overlap or lag. The figures of the mines report may be expected to fall normally below those of the mint report for reasons outlined, and also because of the difficulty in many cases for the mint report of completely separating figures for foreign metal treated in large amount in domestic plants.

For the last five years the final figures from mint and mine returns have been as follows:

Production of gold and silver, 1905–1909, according to mint and to mine returns.

Year.	Mint.		Mine.	
	Gold.	Silver.	Gold.	Silver.
		Ounces.		*Ounces.*
1905	$88,180,700	56,101,600	$88,159,881	56,272,496
1906	94,373,800	56,517,900	97,219,645	57,362,455
1907	90,435,700	56,514,700	87,471,136	52,500,104
1908	94,560,000	52,440,800	91,914,891	50,878,140
1909	99,673,000	54,721,500	99,438,144	57,315,677
Total	467,223,200	276,296,500	464,203,697	274,328,872

These figures show an excess of gold according to mint reports for the five years of $3,019,503, or a difference of a little over 0.6 per cent and a corresponding excess of silver production of 1,967,628 fine ounces, or a difference of about 0.7 per cent. As figures for Alaska are not claimed to be much closer than 3 per cent, the differences for the United States proper are even lower. It is thought these relatively small differences may be accounted for by the explanation already given. Excess of mining over smelting and refining whether of gold and silver or of base metal ores or both, is indicated by larger figures in mine reports for gold or silver or both; and normal conditions, or perhaps excess of smelting and refining over mining by drawing upon stocks, is suggested by the reverse. It may be repeated that the study of production of metals from mixed ores in the West is full of difficulties owing to the complex nature of the problem; but the Survey is confident from field investigations that the results are of increasing accuracy, especially in States like Colorado, where the situation yields satisfactory results only after most painstaking effort and detailed work.

UNITS OF MEASUREMENTS.

Gold and silver are measured by the fine ounce. In the computing tables prepared by the Bureau of the Mint and the Geological Survey gold is given as valued at $20.671834625323 per fine ounce. The average commercial price in New York for silver in 1909 is taken as 52 cents per fine ounce. The standard Survey unit for ore production is the short ton of 2,000 pounds.

PRODUCTION OF GOLD AND SILVER REPORTED FROM THE MINES.

The following table gives the quantity and the value of gold and silver reported from the producing mines in 1909 to the United States Geological Survey. The increase or decrease of production shown results from comparison with the corresponding mines reports as published in Mineral Resources for 1908:

Mine production of gold and silver in the United States in 1909 as reported to the United States Geological Survey, by States and Territories, in fine ounces.

State or Territory.	Gold.		Silver.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Gold, value.	Silver, quantity.
Alabama	1,414.44	$29,239	212	$110	− $11,969	− 70
Alaska	987,416.76	20,411,716	147,950	76,934	+1,118,898	+ 12,278
Arizona	132,426.56	2,737,500	2,601,161	1,352,604	+ 305,523	− 207,289
California	979,006.96	20,237,870	2,098,253	1,091,092	+1,476,311	+ 450,975
Colorado	1,063,734.13	21,989,336	8,902,633	4,629,369	− 311,291	− 2,800
Georgia	2,932.49	60,620	202	105	+ 4,413	+ 2
Idaho	70,328.64	1,453,822	7,041,633	3,661,649	+ 10,363	− 428,348
Illinois			1,001	520		− 1,050
Massachusetts, New Hampshire, and Pennsylvania	335.24	6,930	3,493	1,817	+ 2,562	− 2,777
Michigan			286,430	148,944		+ 35,375
Missouri			14,188	7,378		− 34,943
Montana	183,414.30	3,791,510	12,378,714	6,436,931	+ 733,870	+2,022,515
Nevada	785,608.21	16,239,963	10,981,061	5,710,152	+4,877,022	+1,472,597
New Mexico	11,585.38	239,491	397,783	206,847	− 59,266	− 7,261
North Carolina	1,946.13	40,230	499	259	− 57,265	− 761
Oregon	37,827.51	781,964	27,827	14,470	− 83,112	− 15,775
Philippines	11,977.64	247,597	3,000	1,560	+ 16,262	+ 647
Porto Rico	29.02	600				− 3
South Carolina	534.69	11,053	44	23	− 42,662	− 182
South Dakota	318,202.82	6,577,836	194,273	101,022	−1,079,540	− 54,489
Tennessee	199.21	4,118	57,637	29,971	+ 419	− 59
Texas	15.19	314	374,444	194,711	+ 314	− 69,892
Utah	203,491.76	4,206,548	11,717,172	6,092,929	+ 505,161	+3,265,834
Virginia	181.41	3,750	4,825	2,509	+ 1,299	+ 4,589
Washington	17,514.22	362,051	79,488	41,334	+ 119,817	− 9,335
Wyoming	197.66	4,086	1,754	912	− 3,873	− 2,244
Total	4,810,320.57	99,438,144	57,315,677	29,804,152	+7,523,256	+6,437,534

An increase in production of gold valued at $7,523,256 and of 6,437,534 fine ounces of silver is shown by the mines report for the United States for 1909, as compared with the corresponding figures for 1908.

The production was contributed by 26 States and Territories and by Porto Rico and the Philippines.

In output of gold the principal producers ranked as follows: Colorado, Alaska, California, Nevada, South Dakota, Utah, Montana, Arizona, and Idaho, or in the same relative order as in 1908. No other State or Territory produced as much as $1,000,000 in gold. The most notable increases in output are seen to be for Nevada, $4,877,022; for California, $1,476,311; and for Alaska, $1,118,898. The heaviest decrease was in South Dakota, $1,079,540.

In output of silver the principal producers ranked as follows: Montana, Utah, Nevada, Colorado, Idaho, Arizona, and California, the only change since 1908 being that Utah has moved from fourth to second place, sending Nevada and Colorado down one place each. The conspicuous increases in silver production in 1909 as compared with the output for 1908 were: 3,265,834 ounces in Utah, 2,022,515 ounces in Montana, and 1,472,597 ounces in Nevada. Although 17 States and Territories had decreased mine production of silver, the largest decreases were of 428,348 ounces in Idaho and 207,289 ounces in Arizona. In no other State was the decrease as high as 70,000 ounces.

MINE PRODUCTION BY STATES AND TERRITORIES.

Alaska.—The gold production of Alaska in 1909 was valued at $20,411,716, an increase over the output of 1908 of $1,118,898. There was an increase in production of gold from siliceous ores from $3,357,335 in 1908 to $4,117,440 in 1909, and of gold from placers from $15,888,000 in 1908 to $16,252,638 in 1909; but a decrease of gold from copper ores from $47,483 to $41,638, corresponding to a decrease in copper production from 4,585,362 pounds in 1908 to 4,124,705 pounds in 1909. The Alaskan output of gold was as follows: From the Pacific coast belt, including southeastern Alaska and Prince William Sound, $4,264,716; from the Copper River and Cook Inlet region, $265,000; from the Yukon basin, $11,580,000; and from the Seward Peninsula and northwestern Alaska, $4,302,000. There was an increased production of $816,398 and $1,257,000, respectively, in the first and third of the above-named regions, and there were decreases of $136,500 and $818,000 in the second and fourth. About three-fourths of the gold of Alaska is still derived from placers, but the production from this source tends to decrease, while that from deep mines is on the increase. The Fairbanks district, in the Yukon basin, increased its output from $9,200,000 in 1908 to $9,650,000 in 1909. Unless the large bodies of low-grade gravels are more extensively worked, however, the output of this district can hardly be expected to continue to increase. In Seward Peninsula production of placer gold continued on the decline, partly due to exhaustion of the richest ground and partly due to shortage of water.

The production of silver in Alaska in 1909 was 147,950 fine ounces, an increase of 12,278 ounces over the output for 1908. The greater part of the silver was obtained in the refining of placer gold, but 31,391 ounces came from siliceous gold ores and 22,549 ounces were derived from the smelting of Alaskan copper ores. The increase in silver production for 1909 was from placer gold, the silver from copper ores showing a decrease and that from siliceous gold ores remaining as in 1908.

Arizona.—The gold production of Arizona in 1909 was $2,737,500—an increase of $305,523. The counties leading in output were Yavapai with $952,243; Yuma, with $779,567; Cochise, with $496,951; and Mohave, with $356,363. Pinal County ranked next, with $53,405, followed by Graham, with $38,682. The production of gold from Yavapai County fell off $164,550 in 1909, while that of Yuma County increased $410,752 or considerably over 100 per cent, largely from treatment of ores by the cyanide process in the Golden Star and the King of Arizona mills in the Kofa district. The gold output of Cochise County, largely from smelting ores, decreased $32,367, because of decrease in production from siliceous ores that more than offset increased output from copper and lead ores. The production from Mohave County, which was chiefly from milling ores treated principally by the cyanide process, increased $60,627. The idleness of the Gold Road mine, the principal producer of 1908, materially reduced the output of this county. Of the Arizona gold production of 1909, siliceous ores furnished $1,521,238, chiefly from Yuma, Mohave, and Yavapai Counties in order named; copper ores supplied $829,894, mainly from Yavapai and Cochise Counties (chiefly from Verde and Warren districts, respectively); copper-lead ores produced $267,490, almost entirely from Yavapai County; and lead ore and zinc ore together, the former mainly from Cochise County, the latter wholly from Mohave County, produced $90,230. Placers produced $28,648, against $30,937 in 1908. The placer gold is mostly from Yavapai, Yuma, and Pima Counties in rapidly decreasing importance in order named.

The silver output of Arizona in 1909 was 2,601,161 fine ounces, a decrease of 207,289 ounces. Cochise County produced 1,454,390 fine ounces, against 1,630,749 ounces in 1908. The output was largely from Bisbee copper ores and Tombstone silver-lead-gold mines, and was classified as follows: From copper ore, 961,814 ounces; from siliceous ore, 293,680 ounces; and from lead ore, 198,896 ounces. Yavapai County ranked next in silver output, producing 578,580 ounces in 1909, of which 483,820 ounces came from copper ores. Pima and Gila Counties followed in order, with 199,787 and 155,493 ounces, respectively, mainly from copper ores; and Graham and Mohave followed. Of the total silver output copper ores yielded 1,830,998 ounces; siliceous ores, 407,757 ounces; and lead ores, 234,709 ounces.

California.—The production of gold in California in 1909 was $20,237,870, an increase of $1,476,311 over the output for 1908. The larger part of the increase was due to activity in dredging, although gold production from drift and deep mines increased also. By counties, the greatest increases in output were from Sacramento and Yuba counties, mainly from dredging, and from the Mother Lode in Amador County, the copper and gold quartz mines of Shasta County, and the quartz mines of Grass Valley and Nevada City, in Nevada County. The most important decreases were from quartz ores in Sierra County and in the dredging fields of Butte County. The last-named, however, remained in 1909 the most important gold producing county of the State, with an output of $2,987,079, followed by Nevada County, with $2,660,235, Yuba, with $2,469,865, and Amador, with $2,298,785. The five Mother Lode counties—Amador, Calaveras, Eldorado, Mariposa, and Tuolumne—whose ores are mostly gold-quartz, produced altogether $4,821,416 in gold in 1909, as against $4,835,332 in 1908. The total average recovery from Mother Lode ores in 1909 was $3.60 per ton in gold and silver, as against $3.72 in 1908 and $4.66 in 1907. The dredging industry has steadily grown in importance in California in the last ten years, increasing from an output of $206,302 in 1899 to a production of $7,382,950, the largest in the history of the industry, in 1909. The total production of the dredges of California in the last ten years has been $32,768,521. Placer gold production from all sources in California in 1909 was valued at $9,104,433. Of this, $605,608 was from 134 hydraulic mines, $739,797 was from 118 drift mines, and $376,078 was from 241 surface or sluicing mines, and the remainder, $7,382,950, was from 63 dredges. The total gold production from California deep mines in 1909 was $11,133,437, of which $10,433,402 came from siliceous ores (about $400,000 more than in 1908), $691,062 resulted from smelting copper ores (an increase of over $200,000), and $8,975 came from lead ores.

The production of silver in California in 1909 was 2,098,253 fine ounces, an increase of 450,975 fine ounces over the output of 1908. From placer gold were recovered 40,967 fine ounces of silver and from siliceous (mainly gold-quartz) ores were recovered 456,826 fine ounces. Copper ores yielded 1,539,665 fine ounces of silver and lead ores 60,795 fine ounces. Production of silver decreased from placers and siliceous ores and increased materially from copper ores and slightly from lead ores. The copper mines of Shasta County produced 1,386,817 fine ounces of silver in 1909, and those of Calaveras County 119,696 fine ounces. From siliceous ores Kern County produced 195,365 fine ounces of silver. Although the greater part of the California silver production is derived from the refining of gold and copper, there are 12 silver and silver-gold mines in the State, of which 9 are in San Bernardino County, the chief value of whose ores is in silver.

Colorado.—In 1909 the production of gold in Colorado was $21,989,336, or $311,291 less than in 1908. The output of Cripple Creek decreased $1,269,614, because in part of curtailment of operations in the deeper levels pending the completion of the Roosevelt drainage tunnel, but corresponding increases of production were found in Ouray County, where the output increased $1,016,127 in 1909, in Lake (Leadville), Summit, and Park counties, where the increases were, respectively, $206,982, $265,825, and $121,113; and in Boulder, Custer, Hinsdale, and La Plata counties, where the increases were less important. In addition to Teller County (Cripple Creek) there were notable decreases of gold production in 1909 in Clear Creek, Gilpin, and San Juan counties, and less important decreases in Chaffee, Eagle, Mineral, and San Miguel counties. The chief gold producing counties of Colorado, with their outputs for 1909, were as follows: Teller, $11,470,673; Ouray, $3,044,825; San Miguel, $2,285,051; and Lake, $1,435,431. Other counties producing over $500,000 in gold in 1909 were Gilpin, San Juan, Clear Creek, and Park, in order named. The output of Summit County was $452,766, and Boulder, Gunnison, La Plata, and Mineral counties each produced over $100,000. The San Juan region, including San Juan, San Miguel, Ouray, Dolores, Hinsdale, Montezuma, and La Plata counties, produced altogether $6,170,201, as against $5,486,823 in 1908. The Clear Creek region, including Boulder, Clear Creek, and Gilpin counties, produced $1,586,991 in 1909, as against $1,882,158 in 1908. Of the total ore tonnage in 1909, dry and siliceous ores made up 79 per cent, and yielded $20,478,025, or 93 per cent of the gold; lead ores yielded a little less than 2 per cent; copper ores, about 2 per cent; lead-zinc ores, less than 1 per cent; placers, a little over 2 per cent; and copper-lead and zinc ores the remainder. The output of placer gold in Colorado was $458,492 in 1909, an increase of $273,557 over the placer production of 1908 and of $357,662 over that of 1907. Four dredges and 1 small drift mine in Summit County produced over 88 per cent of the placer gold in 1909, and hydraulic mines in Chaffee and Park counties produced most of the remainder. In metallurgical treatment cyanidation has been displacing chlorination. In the Cripple Creek district all of the operating mills use the cyanide process, and of the Cripple Creek ore sent to the large mills at Colorado City 60 per cent was treated by cyanidation and the remainder by a combined cyanide-chlorination process.

The silver production of Colorado in 1909 was 8,902,633 fine ounces, against 8,905,433 fine ounces in 1908. Lake County (Leadville) produced 38 per cent of the yield of the State in 1909, as against

32 per cent in 1908, and increased its production by over 500,000 ounces. There was a notable increase of silver production from Mineral County, also, and Boulder, Eagle, Gunnison, Hinsdale, Park, and Summit counties made a notable increase in the aggregate. The production of Pitkin County decreased 341,662 ounces, and decreases were noted for San Juan, San Miguel, Clear Creek, Dolores, Gilpin, and Ouray counties. The production for the leading counties in 1909 is as follows: Lake, 3,423,642 fine ounces; San Miguel, 1,344,152 ounces; Mineral, 891,185 ounces; San Juan, 793,637 ounces; Pitkin, 700,038 ounces, and Clear Creek, 448,535 ounces. The districts of Leadville, Aspen, and Creede, combined, producing mainly smelting ores, made an output of 4,657,884 fine ounces, against 4,660,798 in 1908. The San Juan region produced 2,737,239 fine ounces of silver in 1909, against 3,228,150 ounces in 1908; and the Clear Creek counties produced 668,728 fine ounces, against 712,079 ounces in 1908. Siliceous or dry ores yielded 5,716,373 fine ounces of silver in 1909, or 64.2 per cent of the total production; lead ores, 1,127,589 ounces, or 12.7 per cent; copper ores, 1,058,894 ounces, or 11.9 per cent; lead-zinc ores, 681,445 ounces, or 7.7 per cent; copper-lead ores, 303,631 ounces, or 3.6 per cent; and zinc ores and placers the remainder, which was relatively very small.

Idaho.—The gold production of Idaho in 1909 was $1,453,822, an increase of $10,363. Siliceous ore furnished about 75 per cent of the output, mainly from Owyhee, Elmore, Idaho, Lemhi, Custer, and Boise counties, in order named. Copper and lead ores together produced about 6 per cent, chiefly from Shoshone County; and placers, especially of Boise, Nez Perce, Idaho, and Lemhi counties, contributed $281,727, or about 19 per cent of the total. The idleness of the Lost Packer smelter was responsible for a considerable decrease in production from copper ores. The Silver City region, in Owyhee County, furnished nearly 30 per cent of the gold production. In order of production Owyhee County led with $425,305, followed by Boise with $216,031, Idaho with $205,212, Elmore with $193,217, and Lemhi with $129,808. The Boise Basin region, including Idaho City, Placerville, Pioneerville, and Centerville, in Boise County, produced gold valued at $175,852 from 9 deep mines and 39 placers, including dredges. The Elk City district, in Idaho County, produced $174,036 from 3 deep mines and 9 placers; and the Carson district in Owyhee County produced $424,237, largely from the Trade Dollar and De Lamar mines. Dredges alone supplied $101,704 in gold from Idaho in 1909, against $77,189 in 1908.

The silver production of Idaho was 7,041,633 fine ounces in 1909, a decrease of 428,348 ounces from the production of 1908, of 1,373,798 ounces from the output of 1907, and of over 1,925,000 ounces from that of 1906. Although the silver production of Idaho has been steadily decreasing, the rate of decrease has been diminishing each year. The lead ores of Idaho furnished 80.8 per cent of the silver in 1909, or 5,692,906 fine ounces; the siliceous ores, 10 per cent, or 715,858 ounces; the copper ores, 8.5 per cent, or 599,331 ounces; and the lead-zinc and zinc ores and the placers the small remainder—less than 1 per cent of the total. As usual, the Cœur d'Alene region of Shoshone County furnished the bulk of the production, 6,201,157 ounces, or 88 per cent of the State total. Of this quantity 5,602,395 ounces were from lead ores and 594,824 ounces were from copper ores, an increase of silver production from lead ores, but a decrease from copper ores. The siliceous ores of Owyhee County yielded 647,346 ounces in 1909.

Michigan.—The Michigan copper mines produced 286,430 fine ounces of silver in 1909, from the Keweenaw district, an increase of 35,375 ounces over the yield for 1908. The silver output is mainly from the electrolytic refining of certain grades of copper, and the increase or decrease of production of silver from Michigan each year is therefore chiefly dependent upon the quantity of copper refined. In 1909 there was electrolytically refined 31,500,113 pounds of copper, recovered from approximately 1,500,000 tons of rock, and the silver product was 285,066 fine ounces, an average of 0.19 ounce of silver per ton. The remaining silver production, 1,364 ounces, was silver "pickings" recorded from about 149,000 tons of rock, or averaging about 0.009 fine ounce per ton. The "pickings" are but a small portion of the silver in the rock, the remainder going into the copper. The silver production of Michigan is almost wholly from the amygdaloid ores. Of the total output Houghton County furnished 285,066 fine ounces, or all of that recovered in refining, and Ontonagon County all of the "pickings." There was no silver reported from Keweenaw County copper in 1909.

Missouri and Illinois.—The important lead and zinc industries of the Central States contribute very little silver as a by-product. The small production is mainly from lead ores of southeast Missouri, where the silver content is only about 1.2 ounces per ton of concentrates saved. Lead from only about one-sixth of these Missouri ores is desilverized. In 1909 there was reported an output of 14,188 fine ounces of silver from Missouri from 31,000 tons of concentrates saved from about 731,000 tons of crude ore. This silver reported, however, is only about 40 per cent of the silver recovered from the lead ore when smelted, the remainder being in stock as unrefined silver at the close of the year. This production was from the desilverized lead from ore of 5 mines. The production of silver from Missouri in 1908 was 49,131 fine ounces.

In Illinois 1,001 fine ounces of silver were recovered in 1909 from 403 tons of lead concentrates.

Montana.—In 1909 Montana produced $3,791,510 in gold, an increase of $733,870 over the output of 1908. The gain was principally from mines of the Kendall district, in Fergus County, and of the Little Rockies district in Chouteau County. Of the total yield $543,372 was derived from placers, against an output of $549,995 from this source in 1908. The heaviest county production of gold in 1909, $815,368, came from Silverbow County, chiefly from the Butte copper ores. Next in rank was Fergus County with $726,034 from siliceous ores. Madison County followed, with $689,592, with two-thirds of the production from placers and the remainder mainly from siliceous ores. Chouteau County produced about the same value as Madison from the milling and cyaniding ores of the Little Rockies.

The silver production of Montana in 1909 was 12,378,714 fine ounces, an increase of 2,022,515 ounces over the output of 1908. The gain was mainly from copper ores, which produced 10,281,046 ounces of silver in 1909. Over nine-tenths of the total silver production of the State was from the Butte district in Silverbow County. Siliceous ores contributed 1,660,061 ounces of silver, mainly from the Elkhorn

Cataract, and Colorado districts in Jefferson County, and the Flint Creek district in Granite County. The remainder of the output was largely from zinc ores of Butte, in Silverbow County.

Nevada.—The production of gold in Nevada in 1909 was $16,239,963, an increase of $4,877,022, or 43 per cent, over the output for 1908. Of this production, $15,471,481, or 95 per cent, was won from dry or siliceous ores, $365,671 was recovered from copper ores, $319,562 from lead ores, and $82,965 from placers. The siliceous ores were mainly from Esmeralda County, with Goldfield, Silver Peak, and Rawhide as the most productive districts, and from Nye County where the heaviest production came from Tonopah, Bullfrog, and Round Mountain, in the order named. The copper ores were chiefly mined in the Ely district of White Pine County, and the lead ores were largely from the Eureka district in Eureka County. In county production of gold Esmeralda led with $10,521,862, of which the Goldfield district alone supplied $9,383,261, or nearly 58 per cent of the output of the State, against 43 per cent in 1908; the Silver Peak mines yielded $924,318, and Rawhide district $156,002. Nye County followed with an output of $2,945,942 in gold, of which $1,400,361 was from Tonopah, $766,989 from Bullfrog, and $500,648 from Round Mountain. The gold output of Lincoln County decreased from $518,306 in 1908 to $333,384 in 1909, due mainly to the closing of the Bamberger-Delamar mines in the Ferguson district. Storey County produced $556,621 from siliceous ores of the Comstock mines, and Eureka County added $434,672 to the output, of which $419,778 was from Eureka district. White Pine County produced $383,493, of which $370,569 was from Ely, and Humboldt County yielded $380,809, of which $128,671 was from Seven Troughs, $128,120 from Chafey, and $93,942 from the new camp of National. The output of Clark County, until recently the southern part of Lincoln County, was $343,037, of which $335,645 came from Searchlight. The placer production in Nevada in 1909 was mainly from Manhattan and Round Mountain districts in Nye County, and from Lynn (Maggie Creek) district in Eureka County. Increased gold production was notable in Esmeralda, White Pine, Eureka, Humboldt, and Clark counties, but there were important decreases in Lincoln and Nye counties in 1909.

Nevada produced 10,981,061 fine ounces of silver in 1909, an increase of 1,472,597 ounces over the output of 1908. Nye County produced 8,246,496 ounces, or over three-quarters of the output of the State, and of this quantity 7,872,967 fine ounces were from the siliceous ores of Tonopah, and 289,348 ounces came from Bullfrog. Esmeralda County produced 1,299,090 fine ounces, of which 1,043,036 ounces were from the Lucky Boy district, 89,833 ounces were from Rawhide, 65,627 ounces came from Hornsilver, and only 33,164 ounces were from Goldfield. Storey County produced 501,625 fine ounces of silver from the Comstock; and Lincoln County yielded 224,852 ounces, of which 182,923 ounces came from the old camp of Pioche. Eureka County produced 187,710 ounces of silver, of which 179,315 ounces were from Eureka district; and Churchill County produced 140,204 ounces in 1909, of which 139,858 ounces were from Fairview. White Pine County produced 110,325 fine ounces, of which 79,487 were mainly from the Ely copper ores. In 1909 siliceous ores in Nevada yielded 86 per cent of the output and 503,186 ounces of the increase for the State, largely from Nye County. Lead ores produced 13 per cent of the output and 933,398 ounces of the increase, chiefly from Eureka and Lucky Boy. Copper ores yielded a relatively small output of 74,618 ounces, but this was double the quantity of silver from the same source in 1908.

New Hampshire.—There was a small production of gold and silver from copper ores of the Milan mine, New Hampshire, in 1909, and the figures have been combined with those of copper ores from Maryland and of the Cornwall iron mine in Pennsylvania. Concentrates from ores of the Cornwall mine are saved by magnetic separation and briquetted by the Gröndal process, the result being increased purity of the iron ores and a marketable product of copper-iron sulphides carrying small quantities of gold and silver.

New Mexico.—The production of gold in New Mexico in 1909 was $239,491, a decrease of $59,266 from the output of 1908. Socorro County led in the production of gold, with $136,499, or 57 per cent of the State output. Next in order were Grant County, with $37,826; and Lincoln, with $23,863. The siliceous ores, mainly from Grant, Lincoln, Sierra, and Socorro counties, produced 87 per cent of the total gold yield in 1909. Copper ores, chiefly from Grant and Sierra counties, furnished 3 per cent, and lead ores, less than 1 per cent. Placer gold amounted to $22,010, or 9 per cent of the total output. All of the smelters of New Mexico were idle in 1909, the shipping ores going mainly to the El Paso and Copper Queen smelters. The principal placer district, near Elizabethtown and Baldy, in Colfax County, produced $16,037 in placer gold. The Mogollon district of Socorro County was again the most important producer of gold from deep mines. The ores are mainly siliceous milling and cyaniding ores.

The silver production of New Mexico in 1909 was 397,783 fine ounces, a decrease of 7,261 ounces. Of this output Socorro County contributed 269,061 ounces, or 67.6 per cent of the total from siliceous milling ores, mainly from the Mogollon district. Grant County supplied 74,198 ounces, or 18.6 per cent, mainly from siliceous, copper, lead, and zinc ores. For the Territory, siliceous ores supplied 81 per cent of the total output, copper ores 6 per cent, lead ores 9 per cent, and lead-zinc ores 4 per cent.

Oregon.—The gold production of Oregon in 1909 was $781,964, a decrease of $83,112 from that of 1908. Of this decrease $51,275 was from falling off in output from placer mines, the remainder resulting from diminished returns from deep mines owing to lower general average value of ores treated. Baker County again led in output of gold, with $417,538, mainly from Cracker Creek and Cornucopia districts. Josephine County produced $148,997, of which $105,793 was from hydraulic placers. Jackson County produced $100,218 in gold, of which $70,612 was from placer operations, including dredges at Gold Hill and Woodville. No other county produced as much as $50,000 in gold in 1909. Southwestern Oregon, in which Josephine and Jackson are the most important counties, produced $274,245 in gold in 1909, an increase of $23,601. Of the total output $185,252 was from placers. Northeastern Oregon, including Baker, Grant, and other counties, produced $507,719, a decrease of $106,713. The placer yield was $36,066, or $43,043 less than in 1908, and the deep mines of this region produced $471,653.

The silver production of Oregon in 1909 was 27,827 fine ounces, a decrease of 15,775 ounces. Of the total production Baker County contributed 19,514 ounces, mainly from siliceous ores. This class of ores supplied 25,546 fine ounces in 1909.

Southern Appalachian States.—The gold production from Alabama, Georgia, North Carolina, South Carolina, Tennessee, and Virginia combined was $149,010, against $254,775 in 1908. The decrease was largely due to mine accidents at the few largest mines. Considerable decreases were reported from North Carolina and South Carolina and from Alabama. The other States slightly increased their output of gold. Georgia led the production with $60,620, followed by North Carolina with $40,230 and Alabama with $29,239. South Carolina produced $11,053; Tennessee, $4,118; and Virginia, $3,750. The production was mainly from siliceous ores, mined chiefly in Georgia, North Carolina, and Alabama in 1909. Placers, mainly in Georgia and North Carolina, made relatively important contributions to the gold output. The value of the total placer output was $30,297 in 1909.

The silver production of the Southern States in 1909 was 63,419 fine ounces, an increase of 3,519 ounces. Of the total output 57,637 ounces came from refining of copper from the copper ores of Tennessee. The small remainder came from copper ores from Virginia and North Carolina and from refining gold from siliceous ores and placers.

South Dakota.—The production of gold from South Dakota in 1909 was $6,577,836, a decrease of $1,079,540 from that of 1908. Of this decrease over $1,000,000 was caused by the shutdown of the Homestake mines and mills in the Black Hills (which produce over 75 per cent of the State total) in the latter part of November. The total production of gold in South Dakota for the period 1899–1909, inclusive, has been $66,017,539, or at an average of $6,601,754 per annum. The production was almost wholly from siliceous milling ore. The silver output of South Dakota, derived from refining of mill bullion, was 194,273 fine ounces in 1909.

Texas.—The gold production of Texas is merely nominal and a by-product. The production of silver in 1909 was 374,444 fine ounces, a decrease of 69,892 fine ounces from the output for 1908. The output of silver is almost wholly from milling dry or siliceous ores of the Shafter district of Presidio County.

Utah.—The production of gold in Utah in 1909 was $4,206,548, an increase of $505,161 over the output for 1908. The production was chiefly from deep mines of the Tintic district of Juab and Utah counties, Bingham district of Salt Lake County, and Camp Floyd district of Tooele County. There was increased output from the Tintic and Bingham districts in 1909, but the Camp Floyd production has been decreasing for the past six years. Over half the gold from Utah is from copper ores and a fifth is derived from lead ores. The smelters, therefore, recover more than the mills. The latter, principally using the cyanide process, produced $824,009 in 1909. The smelters received $2,747,898 in gold in crude shipping ore alone in 1909. Placers produced only $2,525, a decrease of $6,585 from that source. Salt Lake County produced $1,529,863 in gold, and was followed by Juab County with $1,448,096, and by Tooele County with $820,486. The Tintic district produced $1,719,679; the Bingham district, $1,521,436; the Camp Floyd district (Mercur and Sunshine),

$813,724; and the Park City district, in Summit and Wasatch Counties, $99,518.

The silver production of Utah in 1909 was second only to that of Montana in the United States. The output was 11,717,172 fine ounces, an increase of 3,265,834 over that of 1908. The production is mainly from the smelting of lead ores, to which source 8,314,766 ounces were credited. Copper ores produced 2,500,717 fine ounces; siliceous ores, 402,313 ounces; lead-zinc ore, 399,396 ounces; and copper-lead ore, 99,958 ounces. Tintic district produced 6,404,847 ounces, mostly from lead and copper ores, in 1909; Uinta (Park City), 2,454,605 ounces, mainly from lead ores; and Bingham, 1,615,394 ounces from mixed ores.

Washington.—The gold production of Washington in 1909 was $362,051, an increase of $119,817 over that of 1908. Ferry County led in production, with $210,437, followed by Stevens, with $121,498. The siliceous ores, mainly from these counties, yielded $354,927, and the placers, chiefly from Kittitas County, yielded $5,988. The small remainder came from copper ores. The most important district was Republic, which produced $209,114 from siliceous smelting ore.

The silver production was 79,488 fine ounces in 1909, a decrease of 9,335 from the output for 1908. The production was mainly from siliceous ores of Ferry County and copper and siliceous ores of Stevens County.

Wyoming.—The production of gold in Wyoming in 1909 was $4,086, a decrease of $3,873 from the output of 1908. The decrease was principally due to idleness of the copper mines and the smelter at Encampment, in Carbon County. Of the production of 1909, $2,054 was derived from siliceous ores and $1,114 from placers. The silver production, mainly from copper ores, decreased from 3,998 fine ounces in 1908 to 1,754 ounces in 1909.

Philippine Islands.[a]—The gold production of the Philippines in 1909 was $247,597, an increase of $16,262 over the output for 1908, and of about $177,000 over that of 1907. From the mountain province in northern Luzon, embracing the small placers and important lode mines and cyanide plants of Benguet (which district furnishes the greater part of the gold), and also the former provinces of Lepanto and Bontoc, was reported $128,200 in 1909; from Ambos Camarines, in southeastern Luzon, where are the dredging and other placer fields and lode mines of Paracale and Mambulao, was reported $108,350; from the central provinces of Nueva Ecija and Pangasinan, in Luzon, $4,850; and from Ilocos Sur in the northwestern part of the Island, and from Tayabas in the southern part, $893—a total from the Island of Luzon of $242,293. The remainder of the Philippine output in 1909, $5,304, came from Surigao in the northern part of the southern island of Mindanao. The Masbate mills were idle in 1909. Development continues active in the Philippines, especially in Luzon and Masbate, and the gold output may be expected to increase.

Silver production from the Philippines is nominal, being merely that of recovery in the refining of gold bullion.

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[a] For information relating to the production of the Philippines, the United States Geological Survey acknowledges cooperation with the division of mines, Bureau of Science, Manila, Philippine Islands, to which direct returns are made from the mines, and which has published the results in reports for 1907, 1908, and 1909, entitled "The mineral resources of the Philippine Islands."

NUMBER OF MINES, ORE PRODUCTION, AND AVERAGE VALUES.

The following table indicates the number of mines divided into placers and deep mines that produced the precious metals in 1909. The placers are those in which gold, the silver in natural alloy with the gold, and platinum, in a few instances, are recovered from gravels and sands, whether by hand washing, sluicing, "hydraulicking," drifting (in frozen ground or ancient, buried river channels), or dredging. The deep mines are those producing gold and silver mainly from underground workings, including those whose ores are chiefly valuable for copper, lead, or zinc, but which contribute precious metals as by-products. In addition to producing mines here enumerated a much larger number were being prospected and developed without making an output in 1909; and a very much greater number of mining claims were held merely by the small legal requirement for annual assessment work or were only staked and recorded. These last are not yet "mines."

The enumeration of placer mines is less satisfactory than that of deep mines, owing to the temporary nature of some of the operations and the production frequently obtained from transitory miners not regularly working placer ground. The unit, so far as possible, is, however, as for the deep mines, not the operator, but the claim or group.

Number of producing mines in 1909, by States and Territories.[a]

State or Territory.	Number of mines.		
	Placer.	Deep.	Total.
Alabama and Georgia	17	15	32
Alaska	1,000	19	1,019
Arizona	25	243	268
California	556	571	1,127
Colorado	21	904	925
Idaho	189	135	324
Michigan	....	[b] 8	[b] 8
Missouri	....	[b] 5	[b] 5
Massachusetts, New Hampshire, Pennsylvania, and New Jersey	....	4	4
Montana	170	449	619
Nevada	41	376	417
New Mexico	17	111	128
North Carolina	18	15	33
Oregon	96	66	162
South Carolina	6	5	11
South Dakota	5	26	31
Tennessee	2	5	7
Texas	....	6	6
Utah	5	174	179
Virginia	5	3	8
Washington	11	35	46
Wyoming	3	8	11
Total	2,187	3,183	5,370

[a] Illinois, Philippines, and Porto Rico not included.
[b] Number of mines contributing to silver production in 1909.

The table shows the number and distribution of producing gold and silver mines in the United States and Alaska. With the exception of (1) some of the Michigan copper mines and (2) all zinc mines in the Eastern and Central States and all the lead mines of the Central States (except a few in Illinois and southeast Missouri), practically all mines producing copper, lead, and zinc in the United States and Alaska yield gold and silver also. The table, therefore, with these exceptions and that of Illinois (to whose individual mines silver production can not be traced), is a table of producing gold, silver, copper, lead, and zinc mines of the United States.

Comparisons with corresponding figures for 1908 show a net total decrease of 93 producing mines in 1909. The number of deep mines increased by 319, but the number of placer mines decreased by 412. The latter decrease is more apparent than real, however, for improvement in the enumeration of producing placers in Alaska has given an apparent decrease in the number of mines, whereas the operations for 1909 were really increased. It has always proved difficult to record all the small placer operations of Alaska and the number of mines, as distinguished from operators, as given for 1908 was probably high. Aside from Alaska, increases in number of producing placers are noted for Montana and Nevada, and decreases for Colorado, Idaho, New Mexico, Oregon, generally in the Southern Appalachian States, and Washington. The number of placer producers in California was about the same in both years. The number of deep producing mines in the United States continues to increase, having been 2,114 in 1906, 2,604 in 1907, 2,864 in 1908, and 3,183 in 1909. Notable increases in number of producing deep or lode mines are recorded for 1909 in California, Colorado, and Montana, in which additions were 76, 280, and 40, respectively, and decreases are noted for Arizona, Idaho, and Nevada. The number of producing deep mines in other States remained about the same as in 1909.

The best index of deep mining is, of course, the tonnage and content and value of ore mined, rather than the number of mines or operators. In the next following table are given the ore production by classes of ore and by States and Territories in short tons of mines producing gold and silver and the average extraction value of precious metals per ton.

The classification adopted is necessarily arbitrary in part. An ore is generally understood to be worked at a profit for one or more metals. The complex nature of western ores especially and the insensible gradations from one to another render essential some fixed measures for the terminology used. The dry or siliceous ores comprise gold and silver ores proper. These can not conveniently be subdivided between gold ores and silver ores, for both metals occur together in all proportions, and the table is one of primary classification rather than of great detail. The quantity of purely silver ores and the number of mines producing them are also relatively small. The copper ores include those containing over 2½ per cent of copper, or below this, in the case of ores of the great disseminated copper deposits and the Lake Superior ores. The lead ores are those containing 4½ per cent or more of lead, and the zinc ores those containing 25 per cent or more of zinc, both irrespective of their precious-metal content.

The total quantity of ore mined and treated and producing gold and silver in 1909 was 30,564,557 short tons, an increase of 4,118,711 tons, or 15.5 per cent, over the tonnage for 1908. The increase was mainly in the copper ores, of which more than 4,000,000 tons were mined and treated in excess of the corresponding tonnage for 1908. Dry or siliceous ores increased 121,711 tons; lead ores decreased 148,190 tons; zinc ores (of slight importance in production of precious metals) decreased 11,004 tons; mixed copper, lead, and zinc ores dropped from 67,971 tons in 1908 to 32,193 tons in 1909; but lead-zinc ores increased from 240,934 tons to 322,477 tons in 1909.

Ore production in short tons and average extraction value of gold and silver per ton in 1909, by States and Territories.[a]

State or Territory.	Dry or siliceous ores.		Copper ores.		Lead ores.		Zinc ores.		Copper-lead and copper-lead-zinc ores.		Lead-zinc ores.		Total.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.
Alabama, Georgia	18,435	$3.99											18,435
Alaska	1,496,361	2.76	34,669	$1.55									1,531,030
Arizona	237,078	7.31	3,741,713	.48	27,658	$6.39	6,696	$8.78	16,810	$18.47			4,029,955
California	2,195,741	4.86	840,358	1.78	5,589	7.26							3,041,688
Colorado	1,749,112	13.41	60,673	16.32	174,483	5.41	5,014	1.07	9,267	27.03	221,192	$2.34	2,219,741
Idaho	185,734	7.86	97,803	3.43	1,466,592	2.06	12,000	.16			10,254	1.41	1,772,383
Michigan			[b] 1,649,000	.098									1,649,000
Maryland, New Hampshire, and Pennsylvania			193,066	.05									193,066
Montana	416,329	8.11	4,965,001	1.25	4,678	21.61	34,463	4.29	610	42.93	104	4.63	5,421,185
Nevada	1,229,651	16.58	1,670,457	.24	76,837	13.74			1,021	8.21	1,759	5.08	2,979,725
New Mexico	47,081	7.99	81,144	.25	6,820	2.84			25	4.08	28,893	.29	163,963
North Carolina	3,696	5.07	3,575	6.15									7,271
Oregon	57,634	9.87	1,647	2.92									59,281
South Carolina	3,150	3.06											3,150
South Dakota	1,702,266	3.92	1,875	1.31									1,704,141
Tennessee			576,680	.06									576,680
Texas	21,708	8.97	10	1.98	44	5.86							21,762
Utah	358,116	3.41	4,216,226	.88	480,248	10.55			4,460	12.13	60,275	3.86	5,119,325
Virginia	250	2.09	13,825	.35									14,075
Washington	33,035	11.75	2,382	3.11	891	1.89							36,308
Wyoming	273	7.55	2,120	.86									2,393
Total	9,755,650	7.65	18,152,224	.83	2,243,840	4.65	58,173	3.68	32,193	20.18	322,477	2.42	30,564,557
Per cent of tonnage	31.92		59.39		7.34		.19		.11		1.05		100.00

[a] Illinois, Kentucky, Missouri, Philippines, and Porto Rico not included in this table.

[b] Includes only copper ore yielding precious metals.

The production of dry or siliceous ores increased 277,771 tons in Nevada, 170,147 tons in California, 60,077 tons in Idaho, and by smaller quantities in Montana, Alaska, New Mexico, Oregon, Washington, and Utah. Production decreased 227,247 tons in South Dakota, 138,422 tons in Arizona, 81,818 tons in Colorado, and by smaller quantities in North Carolina and South Carolina. A few important mines are responsible for the decrease and, in Nevada, largely for the increase, of output of siliceous ore.

In output of copper ore in 1909 the most notable increases were as follows: Utah, 1,239,793 tons; Nevada, 1,235,570 tons; Montana, 1,136,125 tons; Arizona, 426,573 tons; and California, 326,944 tons. The two leading States owe their great progress to the mining of the disseminated copper ores of little depth; production in Montana and California is credited to true deep mines. In Arizona output of the disseminated ores is rapidly approaching first rank. Smaller increases of output of copper ores are noted for Colorado, Virginia, and South Dakota; and decreases, amounting in all to about 60,000 tons, are recorded for Wyoming, Alaska, New Mexico, Idaho, Oregon, Tennessee, Texas, and Washington.

Production of lead ores increased slightly in Idaho, and considerably in Utah, Arizona, and Colorado. Output of lead-zinc ores declined in Colorado, but increased materially in Utah and New Mexico, and to a smaller degree in Nevada and Idaho.

The total average extraction value per ton of gold and silver from dry or siliceous ores increased notably from $7.28 in 1908 to $7.65 in 1909. The increase by States in average extraction value from these ores is recorded from $2.28 in 1908 to $2.76 in 1909 in Alaska; from $5.32 to $7.31 in Arizona; from $13.10 to $13.41 in Colorado; from $6.85 to $8.11 in Montana; from $3.03 to $3.41 in Utah; and from $8.57 to $11.75 in Washington. Decreased average extraction value is noted in California from $5.09 to $4.86; in South Dakota from $4.03 to $3.92, and in Idaho, New Mexico, and Oregon. In Nevada the average extraction value was $16.58 per ton in both years.

The total average recovery of gold and silver from copper ores decreased for the United States from $0.91 per ton in 1908 to $0.83 per ton in 1909. The highest recovery was from Colorado ores, in which it decreased from $16.67 in 1908 to $16.32 per ton in 1909; in Idaho the recovery decreased from $4.68 to $3.43, and in New Mexico, from $0.97 to $0.25. In Tennessee the recovery reported increased from $0.03 to $0.06 per ton, and in Michigan from $0.06 to $0.10. In the great copper-producing States of the West decrease in value per ton of precious metal recovery was noted as follows: In Arizona from $0.54 in 1908 to $0.48 in 1909; in California from $1.99 to $1.78; in Montana from $1.32 to $1.25; in Nevada, from $0.26 to $0.24; and in Utah from $1.24 to $0.88.

The average recovery value per ton of gold and silver in lead ores increased from $3.55 in 1908 to $4.65 in 1909. In Idaho the value decreased from $2.19 to $2.06, and in Colorado from $11.58 to $5.41; but in Utah it increased from $10.47 to $10.55, and in Nevada from $11.56 to $13.74. The lead-zinc ores increased in precious metal recovery value per ton from $2.01 in 1908 to $2.42 in 1909; in Colorado the increase was from $2.01 to $2.34 per ton, and in Utah from $2.65 to $3.86 per ton.

DISTRIBUTION OF GOLD PRODUCTION OF 1909.

The following table gives the sources by classes of ore and by States and Territories of the gold output of the United States in 1909:

Source of gold in 1909 in States and Territories, as reported from the mines to the United States Geological Survey, by kinds of ore and by States, in fine ounces.[a]

State or Territory.	Placers.	Dry or siliceous ores.	Copper ores.	Lead ores.	Zinc ores.	Copper-lead and copper-lead-zinc ores.	Lead-zinc ores.	Total.
Alabama	3.34	1,411.10						1,414.44
Alaska	786,221.36	199,181.16	2,014.24					987,416.76
Arizona	1,385.84	73,589.88	40,146.14	2,647.87	1,717.00	12,939.83		132,426.56
California	440,426.95	504,715.72	33,430.12	434.17				979,006.96
Colorado	22,179.55	990,624.45	21,256.12	17,295.86	34.99	4,478.58	7,864.58	1,063,734.13
Georgia	794.95	2,137.54						2,932.49
Idaho	13,628.54	52,634.53	1,180.26	2,863.86			21.45	70,328.64
Massachusetts, New Hampshire, and Pennsylvania			335.24					335.24
Montana	26,285.62	116,703.59	38,001.72	1,666.33	694.93	62.11		183,414.30
Nevada	4,013.43	748,432.90	17,689.33	15,458.81		13.74		785,608.21
New Mexico	1,064.73	10,052.35	397.80	70.50				11,585.38
North Carolina	524.77	1,348.60	72.76					1,946.13
Oregon	10,706.26	26,893.89	227.36					37,827.51
South Carolina	69.90	464.79						534.69
South Dakota	57.03	318,102.49	43.30					318,202.82
Tennessee	30.23		168.98					199.21
Texas		15.19						15.19
Utah	122.15	48,931.33	117,265.85	35,858.36		102.89	1,211.18	203,491.76
Virginia	42.38	25.16	113.87					181.41
Washington	289.67	17,169.64	54.91					17,514.22
Wyoming	53.89	99.36	44.41					197.66
Total	1,307,960.59	3,112,533.67	272,442.11	76,295.76	2,446.92	17,597.15	9,097.21	4,798,313.71
Value	$27,036,705	$64,341,781	$5,631,885	$1,577,173	$50,582	$363,765	$188,056	$99,189,947
Per cent of total	27.26	64.87	5.68	1.59	0.05	0.36	0.19	100.00

[a] Illinois, Philippines, and Porto Rico not included.

General statement.—In 1909 the placers yielded 27.26 per cent of the total gold production and the dry or siliceous ores 64.87 per cent, a total of 92.13 per cent from these sources, there being only 7.9 per cent from the increasingly heavy tonnage of base metal ores. Copper ores supplied 5.68 per cent in 1909 as against 5 per cent in 1908; lead ores furnished 1.59 per cent, and all other ores together only 0.6 per cent. The proportion of gold production from placers decreased slightly in 1909, as that from copper and lead ores increased.

Placers.—The value of the output of placer gold in 1909 was $27,036,705, against $25,617,373 in 1908, $24,659,230 in 1907, and the record output of $27,459,653 in 1906. The gold placer production of Alaska was $16,252,638, against $15,888,000 in 1908. California produced $9,104,433 in placer gold in 1909, against $8,231,187 in 1908. The combined increase in placer production from Alaska and California was, therefore, $1,237,884, of which over two-thirds is to be credited to California. Of the States producing smaller amounts of placer gold Colorado showed a relatively large increase for 1909, but there were slight decreases in Montana and Idaho and a considerable decrease in Oregon.

In California dredging continued to increase in importance and in 1909 supplied $7,382,950 from 63 dredges. This was 81 per cent of the total placer yield of the State and an increase of $846,761 over the dredge output of 1908. From 1899 to 1909, inclusive, the California dredges have yielded $32,768,521 in gold, and during the last nine years there has been an increase every year, except in 1907, when there was a small decrease, partly owing to floods at Oroville. In 1909, however, production was beginning to decrease in the Butte County field, and it does not seem probable that new fields equal to those of Butte, Yuba, and Sacramento counties will be found. Although the number of operating dredges in California decreased by 3 in 1909, there was an increase of 12 boats in the other dredging States. There were 14 dredges operating in Alaska against 4 in 1908, and 8 in Idaho against 5 in 1908; in Colorado 4 dredges were at work in Summit County in both years; in Montana the number decreased from 4 in 1908 to 3 in 1909; and in Oregon there were 2 dredges producing in 1909 against 1 in 1908. The total production from dredges outside of California in 1909 was $1,400,430, against $815,584 in 1908; of this amount Montana contributed $426,439, Alaska $424,993, and Colorado $404,631; the small remainder came from Idaho and Oregon.

In Alaska drift mining produces much of the placer output and in California the production from this source increased from $390,545 in 1908 to $739,797 in 1909. Hydraulic and sluicing placers produced the remainder of placer gold, save for a very small amount recovered by dry placering in the arid parts of the Southwest.

Dry and siliceous ores.—In 1909 dry or siliceous ores produced $64,341,781 in gold, against $59,578,704 in 1908. States producing over $1,000,000 from this class of ore ranked as follows: Colorado, Nevada, California, South Dakota, Alaska, Montana, Arizona, Idaho, and Utah. The output from Nevada alone increased over $4,000,000 from this source, and important increases are also noted for Alaska, Montana, and California, in order named, with smaller ones for Washington and Utah. South Dakota and Colorado suffered material decreases; but little change is noted for Arizona, New Mexico, and Oregon.

The siliceous ores are in part largely free milling, as in Alaska, California, and Oregon; in part both amalgamating and concentrating ores, and in smaller part either straight concentrating ores, as in parts of Colorado and Arizona, or smelting ores. Tailings are now largely concentrated and cyanided and loss of gold from this source is greatly reduced. The use of the chlorination process has steadily given way to the constantly increasing application of cyanidation, in which improvements are yearly being made; and the old pan-amalgamation process is now little used. At Cripple Creek a combined chlorinating cyaniding process is said to be working well. Crushing of gold ores is still mainly by stamps, although rotary mills and rolls are important factors. Smelting is mainly of concentrates, siliceous ores, and pyritic ores. The siliceous ores, as in California, are valuable for fluxing in copper smelters, and the pyritic ores, as of Leadville, are in part smelted crude and in part concentrated first.

Copper ores.—The production of gold from copper ores in 1909 was valued at $5,631,885, against an output of $4,812,993 in 1908. Material increases of gold from these ores are noted for Colorado, Nevada, California, and Utah, in order named, due to increased copper output, and a decrease in production from Idaho, where the Snowstorm mine has been the largest factor. The relative rank and proportion of output in 1909 of the States leading in production of gold from copper ores was: Utah, with 43 per cent; Arizona, with nearly 15 per cent; Montana, with 14 per cent; California, with 12 per cent; Colorado, with nearly 8 per cent; and Nevada, with about 6½ per cent; the remaining States together only furnished about 2 per cent of the total gold from copper ores.

The copper ores are mainly sulphides, with a greater tonnage containing chalcocite than chalcopyrite; and the great disseminated deposits of Utah, Arizona, and Nevada are of constantly increasing importance. These ores are mainly concentrated before smelting. Oxidized ores of decreasing relative importance still come from the Bisbee and Tintic districts; these are commonly smelted crude and are sought for as fluxing ores. Gold in copper ores is mainly recovered in the electrolytic copper refineries and is, therefore, lost and not reported for the relatively small proportion of copper not so refined.

Lead ores.—In 1909 gold from lead ores was valued at $1,577,173, against $1,055,441 in 1908. The production from this source was mainly from Utah, Colorado, and Nevada, in order named, with smaller amounts from Idaho, Arizona, and Montana. Oxidized lead as well as copper ores still come from the Tintic district in Utah, but the bulk of the gold from lead ore is from the sulphides. The output of gold from these ores nearly doubled in Utah in 1909, very slightly decreased in Colorado, more than doubled in Nevada, slightly increased in Idaho, trebled in Arizona, and fell off in Montana.

Zinc ores.—The production of gold from zinc ores in 1909 was $50,582, against $24,674 in 1908. The greater part of the gold from this source came from Montana in 1908 but from Arizona in 1909. There was a notable decrease in Montana and a corresponding increase in Arizona for 1909.

Mixed ores.—Copper-lead and copper-lead-zinc ores furnished $363,765 in gold in 1909, mainly from Arizona, with smaller amounts from Colorado, against $491,973 in 1908, chiefly from Colorado. Lead-zinc ores supplied $188,056 in 1909, against $101,795 in 1908, mainly from Colorado.

DISTRIBUTION OF SILVER PRODUCTION OF 1909.

The following table shows the source of silver production of the United States in 1909, by classes of ore by States:

Source of silver in 1909 in States and Territories, as reported from the mines to the United States Geological Survey, by kinds of ore and by States, in fine ounces.[a]

State or Territory.	Placers.	Dry or siliceous ores.	Copper ores.	Lead ores.	Zinc ores.	Copper-lead and copper-lead-zinc ores.	Lead-zinc ores.	Total.
Alabama		212						212
Alaska	94,010	31,391	22,549					147,950
Arizona	183	407,757	1,830,998	234,709	44,841	82,673		2,601,161
California	40,967	456,826	1,539,665	60,795				2,098,253
Colorado	5,800	5,716,373	1,058,894	1,127,589	8,901	303,631	681,445	8,902,633
Georgia	67	135						202
Idaho	2,878	715,858	599,331	5,692,906	3,750		26,910	7,041,633
Illinois				1,001				1,001
Massachusetts, New Hampshire, and Pennsylvania			3,493					3,493
Michigan			286,430					286,430
Missouri				14,188				14,188
Montana	4,159	1,660,061	10,281,046	128,179	256,456	47,887	926	12,378,714
Nevada	1,534	9,456,840	74,618	1,415,416		15,580	17,073	10,981,061
New Mexico	162	323,962	23,318	34,463		194	15,684	397,783
North Carolina	75	316	108					499
Oregon	2,054	25,546	227					27,827
South Carolina		44						44
South Dakota	13	191,251	3,009					194,273
Tennessee			57,637					57,637
Texas		373,910	38	496				374,444
Utah	22	402,313	2,500,717	8,314,766		99,958	399,396	11,717,172
Virginia	4	4	4,817					4,825
Washington	100	64,078	12,081	3,229				79,488
Wyoming	12	13	1,729					1,754
Total	152,040	19,826,890	18,300,705	17,027,737	313,948	549,923	1,141,434	57,312,677
Value	$79,061	$10,309,983	$9,516,367	$8,854,423	$163,253	$285,960	$593,545	$29,802,592
Per cent of total	0.26	34.59	31.93	29.72	0.55	0.96	1.99	100.00

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[a] Philippines and Porto Rico not included in this table.

General statement.—The total mine output of silver in 1909 was 57,312,677 fine ounces, against 50,875,787 ounces in 1908. The production was, as usual, mainly from siliceous ores, copper ores, and lead ores. In 1909 siliceous ores produced 34.59 per cent of the total, against 39.1 per cent in 1908; copper ores produced 31.93 per cent, against 29.4 per cent in 1908; and lead ores 29.7 per cent, against 27.6 per cent in 1908, or 96.25 per cent of the total in 1909 against 96.1 per cent in 1908, a decrease from dry or siliceous ores being offset by increased output from copper and lead ores. Zinc ores furnished only 0.55 per cent; the mixed copper-lead and copper-lead-zinc ores together only 0.96 per cent, and lead-zinc ores nearly 2 per cent; but the silver recovered from the refining of placer gold, mainly in Alaska and California, was only 0.26 per cent of the total.

Dry and siliceous ores.—Production of silver from dry and siliceous ores in 1909 was 19,826,890 fine ounces, against 19,862,038 ounces in 1908—a decrease from 1908 of 35,148 ounces but an increase over 1907 of nearly 800,000 ounces. Nevada led in the output of silver from these ores with 9,456,840 ounces, against 8,953,654 ounces in 1908, followed again by Colorado with 5,716,373 ounces in 1909, against 5,553,591 ounces in 1908, and by Montana with 1,660,061 ounces, against 1,715,386 ounces in 1908. In order of importance in 1909 the following States ranked next: Idaho, California, Arizona, Utah, Texas, New Mexico, and South Dakota. In addition to increase in silver output from these ores for Nevada and Colorado, there was an important increase only from Utah. Heavy decreases are noted for Arizona and Idaho, and smaller losses for Texas, South Dakota, New Mexico, California, and Oregon. With a few notable exceptions, as in San Bernardino County, Cal., the dry or siliceous ores are gold-silver ores, or silver-gold ores as at Tonopah, the main source of production from this class of ore. In Colorado the output was chiefly from Leadville, and from San Miguel County in the "San Juan country," with Mineral County (Creede), third in importance. The output from Montana was principally from Jefferson, Granite, and Silverbow counties in the order named.

The largest output of silver from these gold-silver siliceous ores was with the gold by amalgamation and cyanidation. Rich ores are usually smelted and the silver is then recovered by refining the lead or copper which collects it in the furnace.

Copper ores.—Mine production of silver from copper ores in 1909 was 18,300,705 fine ounces, against 14,945,189 ounces in 1908, an important increase of nearly 3,455,000 ounces reflecting the growing copper output. Montana led in production from this source, with 10,281,046 ounces, against 8,274,951 ounces in 1908, followed by Utah with 2,500,717 ounces, against 2,620,680 ounces in 1908. Following these in order came Arizona, California, and Colorado each with over 1,000,000 ounces. In addition to the increase of over 2,000,000 ounces of silver from copper ores from Montana, Colorado made the very large increase of over 860,000 ounces, and the output of California increased by over 500,000 ounces. Smaller increases are noted for Arizona, Michigan, and Nevada. The considerable decrease of about 120,000 ounces is recorded from Utah, following a decrease of 800,000 ounces in 1908. The output decreased about 31,000 ounces also in Idaho, and by smaller quantities in Washington and Wyoming, while the production of silver from copper ores in New Mexico, Oregon, and Tennessee remained about as in 1908.

The Montana production was, of course, mainly from Butte, that of Utah from Tintic and Bingham, that of California from Shasta County, and that of Arizona chiefly from the Bisbee and the United Verde camps. Except in Utah the disseminated copper ores are not yet adding heavily to the silver output.

Lead ores.—Silver production from lead ores in 1909 was 17,027,737 fine ounces, against 14,049,481 fine ounces in 1908. The output from Utah was 8,314,766 ounces, against 5,570,548 ounces in 1908, and from Idaho, 5,692,906 ounces, against 5,917,034 ounces in 1908. Nevada ranked third with the notable increase from 482,018 ounces in 1908 to 1,415,416 ounces in 1909. The output in Colorado declined from 1,501,803 ounces in 1908 to 1,127,589 ounces in 1909. The production in Utah was mainly from the Park City district and to a smaller degree from Tintic. The Coeur d'Alenes district furnished the bulk of the Idaho production, and the great increase in Nevada was due to activity in the Eureka and the Lucky Boy camps. The Colorado output was mainly from Aspen and Leadville, with San Juan County ranking third. Although much of this silver production is from rich galena, oxidized silver-lead ores are still mined at Tintic, Aspen, and a few other camps.

Zinc ores and mixed ores.—Zinc ores supplied 313,948 fine ounces of silver in 1909, against 37,605 ounces in 1908, the output being mainly from Montana and the increase from Montana and Utah. The lead-zinc ores contributed 1,141,434 fine ounces in 1909, against 722,906 in 1908, principally from Colorado and Utah. Although the Colorado production declined, that from Utah increased fortyfold, and Idaho, Nevada, and New Mexico entered the list of producers in 1909. The production of silver from copper-lead and copper-lead-zinc ores was 549,923 fine ounces in 1909, against 1,099,283 ounces in 1908. The output was mainly from Colorado, where it declined heavily. Large increases are noted for Arizona and Montana, and a smaller increase for Utah, but these did not offset the decrease of over 635,000 ounces from Colorado and the much smaller falling off in Nevada.

COPPER.

By B. S. Butler.

INTRODUCTION.

The figures showing the production of copper for the year 1909 have been collected by the United States Geological Survey in cooperation with the Bureau of the Census. As this work was in connection with that of the general census of the industries of the United States, and as the figures were collected in part by field agents of the Bureau of the Census who visited the different districts, the time required for the work was much greater than has been necessary in previous years. This fact accounts for the apparent delay on the part of the Survey in presenting the report on the production of copper for 1909.

In the production of metallic copper suitable for commercial purposes three distinct processes are usually required, namely, mining, smelting, and refining. The Lake Superior native copper district is the only important producer where these three processes are not distinct. It is possible, therefore, to ascertain the copper output of the country by collecting statistics from the mines, from the smelters, and from the refiners, and each of these sets of figures has its advantages and its disadvantages. The mine figures have the advantage of giving the most accurate distribution of the production, but are less accurate in total quantity of copper recovered; the smelter figures permit of reasonably accurate distribution and also furnish the actual recovery of copper from the ores treated during the year; the refinery figures furnish the best measure of the copper made available for commercial uses during the year, but at this stage of manufacture the accurate distribution to the State of origin, or even the separation of copper derived from domestic and from foreign sources, is uncertain.

Statistics for 1909 showing the production of each of these stages of manufacture have been collected by the United States Geological Survey, and are presented in the following report.

Since the same material passes through the three processes of manufacture at successive periods, usually requiring two to three months from the time it is taken from the mine before it reaches the stage of refined copper, the year's production as recorded for the different stages does not represent the same materials—that is, the refinery production for the calendar year 1909 represents the mine production from about October 1, 1908, to October 1, 1909. The three sets of figures representing the successive stages of manufacture do not therefore necessarily agree, although they should not differ greatly if the condition of the industry is normal. The mine and the smelter figures will differ by the difference in the quantity of ore, matte, etc., in stock at the beginning and at the end of the year, and by the difference in the quantity of copper reported by the mines and that recovered by the smelters. This difference is due to the fact that considerable copper is recovered from sulphur, lead, and zinc ores carrying values in copper so low that the mines do not receive pay for and frequently do not report the copper content of the ore, although it is eventually recovered by the smelters. The smelter and refinery figures will differ by the increase or decrease in stock of blister, etc., at the beginning and at the end of the year, and by the loss in refining.

Since the smelter production permits reasonably accurate distribution as to source by States and also gives the actual output of copper, it is adopted in this report as the production of the country. It is made up of the production of blister copper and of furnace-refined or ingot copper of the Lake district.

SUMMARY OF STATISTICS.

The following statistical statement summarizes the copper industry in the United States in 1908 and 1909:

Summary of statistics of the copper industry in the United States in 1908 and 1909.

	1908.	1909.
Production of copper:		
Smelter output........pounds..	942,570,721	1,092,951,624
Mine production........do....	956,840,578	1,126,521,126
Refinery production of new copper—		
Electrolytic........do....	629,392,864	778,808,910
Lake........do....	222,289,584	227,005,923
Casting........do....	67,428,966	59,750,088
Total domestic........do....	919,111,414	1,065,564,921
Total domestic and foreign........do....	1,137,962,408	1,391,021,454
Total new and old copper........do....	1,161,176,085	1,480,467,686
Total ore treated........short tons..	22,358,875	28,025,092
Copper ore treated........do....	22,290,886	27,932,618
Average yield of copper........per cent..	2.08	1.98
Imports........pounds..	218,705,487	321,801,114
Exports........do....	661,876,127	682,846,725
Consumption:		
Total new copper........do....	480,000,000	688,000,000
Total new and old copper........do....	503,000,000	778,011,473
World's production........do....	1,683,095,140	1,875,584,624
Value of production in the United States........	$124,419,335	$142,083,711

PRODUCTION.

GENERAL CONDITION OF INDUSTRY.

The year 1909 was one of prosperity for the copper industry of the United States. The output was the largest that has been made in any year, and the average price of copper, 13 cents per pound, although slightly below that of the preceding year, 13.2 cents, was sufficiently high to enable a large percentage of the output to be marketed at a good profit. The principal companies succeeded in reducing still further the cost of production, in some instances as a result of increasing the output, so that the average cost per pound of copper was lower during 1909 than it has been in several years and possibly as low as it has ever been.

Both domestic consumption and export of refined copper was the largest in the history of the industry, so that the record-breaking output of the copper refineries did not result in large additions to the domestic stocks, though the stocks held abroad nearly doubled during the year.

No important new producers were added, though several mines that made but small outputs during 1908 were important producers in 1909. Large tonnages of ore were developed, especially in Arizona and New Mexico, but these will not add materially to the metal output before 1911.

A very notable and important event of the year 1909 was the inauguration of plans for the consolidation of several groups of mines. Some of these plans went into effect in 1910. The most important consolidations taking place during 1909 and early in 1910 were those at Butte, Mont.; Bingham, Utah; Ely, Nev.; Ray, Ariz.; the acquisition of the Bigelow interests in the Lake district by the Calumet and Hecla Company should be included. The consolidation of large producers from several districts that was much talked of during the latter part of 1909 was abandoned owing to the adverse decisions that were rendered by the courts in regard to the Standard Oil Company and the American Tobacco Company. It is probable that no further attempt at a general consolidation of the copper industry will be made before decisions shall have been rendered by the United States Supreme Court in the above-mentioned cases.

Since February 10, 1909, monthly reports of the output of marketable copper, the monthly deliveries for domestic consumption and for export, and the stocks of marketable copper held in the United States at the close of each month, have been made by the Copper Producers' Association. These statements, showing the condition of the industry at the close of each month, have proved of great value and have fully demonstrated the wisdom of the organization of the Copper Producers' Association.

SMELTER AND MINE PRODUCTION.

GENERAL STATEMENT.

The production of copper in 1909 by smelters from copper-bearing materials from the United States was 1,092,951,624 pounds, valued at $142,083,711 [a] as compared with 942,570,721 pounds in 1908, valued at $124,419,335. The production for 1909 was the largest in the history of the industry, exceeding the production of 1908 by 150,380,903 pounds, or 15.95 per cent.

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[a] For discussion of prices see section on prices on a subsequent page.

The yearly production of copper in the United States from 1845 to 1909, inclusive, together with the actual and relative changes from each preceding year, is given in the following table:

Magnitude and growth of copper production in the United States from 1845 to 1909, inclusive.

Year.	Production.	Increase.		Average annual increase by decades.	
	Pounds.	*Pounds.*	*Per cent.*	*Pounds.*	*Per cent.*
1845	224,000			242,400	50.0
1846	336,000	112,000	50.0		
1847	672,000	336,000	100.0		
1848	1,120,000	448,000	67.0		
1849	1,568,000	426,000	40.0		
1850	1,456,000	[a]112,000	[a]7.1		
1851	2,016,000	560,000	23.1	1,467,200	27.0
1852	2,464,000	448,000	22.2		
1853	4,480,000	2,016,000	81.8		
1854	5,040,000	560,000	12.5		
1855	6,720,000	1,730,000	33.3		
1856	8,960,000	2,240,000	33.3		
1857	10,752,000	1,792,000	20.0		
1858	12,320,000	1,568,000	14.6		
1859	14,112,000	1,792,000	14.5		
1860	16,128,000	2,016,000	14.3		
1861	16,800,000	672,000	4.1	1,209,600	6.1
1862	21,160,000	4,360,000	20.0		
1863	19,040,000	[a]2,120,000	[a]5.5		
1864	17,920,000	[a]1,120,000	[a]5.9		
1865	19,040,000	1,120.000	6.3		
1866	19,936,000	896,000	4.7		
1867	22,400,000	2,464,000	12.3		
1868	25,984,000	3,584,000	16.0		
1869	28,000,000	2,016,000	7.7		
1870	28,224,000	224,000	1.0		
1871	29,120,000	896,000	3.2	3,225,600	7.2
1872	28,000,000	[a]1,120,000	[a]3.8		
1873	34,720,000	6,720,000	24.0		
1874	39,200,000	4,480,000	12.9		
1875	40,320,000	1,120,000	2.9		
1876	42,560,000	2,240,000	5.6		
1877	47,040,000	4,480,000	10.5		
1878	48,160,000	1,120,000	2.4		
1879	51,520,000	3,360,000	7.0		
1880	60,480,000	8,960,000	17.4		
1881	71,680,000	11,200,000	18.6	18,930,349	14.8
1882	90,646,232	8,966,232	12.5		
1883	115.526,053	24,886,221	27.4		
1884	144,946,653	29,420,600	25.5		
1885	165,875,766	20,929,113	14.4		
1886	156,735,381	[a]9,140,385	[a]5.5		
1887	180,920,524	24,185,143	15.4		
1888	226,361,466	45,440,942	25.1		
1889	226,775,962	414,496	.2		
1890	259,763,092	32,987,130	14.5		
1891	284,121,764	24,358,672	9.4	34,635,407	9.1
1892	344,998,679	60,876,915	21.5		
1893	329,354,398	[a]15,644,281	[a]4.8		
1894	354,188,374	24,833,976	7.5		
1895	380,613,404	26,425,030	7.4		
1896	460,061,430	79,448,026	20.0		
1897	494,078,274	34,016,844	7.4		
1898	526,512,987	32,434,713	6.6		
1899	568,666,921	42,153,934	8.0		
1900	606,117,166	37,450,245	6.6		
1901	602,072,519	[a]4,044,647	[a].7	54,092,717	7.8
1902	659,508,644	57,436,125	9.5		
1903	698,044,517	38,535,873	5.8		
1904	812,537,267	114,492,750	16.4		
1905	901,907,843	89,370,576	9.4		
1906	917,805,682	29,021,415	3.3		
1907	868,996,491	[a]48,809,191	[a]5.3		
1908	942,570,721	73,574,230	8.4		
1909	1,092,951,624	150,380,903	15.9		

[a] Decrease.

The figures, except for 1909, are taken from the previous volumes of Mineral Resources of the United States. Statistics from 1882 to 1909, inclusive, are based on the returns to the United States Geological Survey by the copper-producing companies. Figures for the years prior to 1882 were compiled by the Survey from the best sources available. Reliable figures for years previous to 1845 are not obtainable. The year 1845, however, marks the entrance of the Lake Superior district into the ranks of producers and is really the beginning of important production of copper in this country. The industry has shown a steady and in recent years a very rapid growth. The few years when there has been a decrease in production, as compared with the preceding year, have in almost every case been years of general financial depression or panic, and the copper industry has been quick to recover when normal business conditions were restored.

The large production during the last part of 1908 and in 1909 indicates that the panic of 1907 proved no exception to the rule. Although the unfavorable financial conditions extended well into the year 1908, the output for that year was the largest ever made, and the output for 1909 showed an increase over that for 1908 greater than the average of increase for the last ten years.

SMELTER RETURNS.

The figures of smelter production for 1909 are based on returns made confidentially to the Geological Survey by all known smelting companies handling copper-bearing materials from the United States. To all companies and officials who have aided in furnishing this information and have given valuable time to answering inquiries to secure the accurate distribution of the output, sincere thanks are extended. The following list gives the names of the owning or operating companies, the location, and the final copper product of plants which contributed to the copper production of 1909. It does not include some lead and zinc plants which recovered small amounts of copper as a by-product.

Smelting plants that treated copper-bearing materials from the United States in 1909.

Location.	Company.	Final copper product.
UNITED STATES.		
Arizona:		
Clifton	Arizona Copper Co	Blister.
Do	Shannon Copper Co	Do.
Douglas	Calumet and Arizona Mining Co	Do.
Do	Copper Queen Consolidated Mining Co	Do.
Globe	Arizona Commercial Copper Co	Matte.
Do	Old Dominion Copper Mining and Smelting Co.	Blister.
Jerome	United Verde Copper Co	Do.
Johnson	Arizona United Mining Co	Matte.
Morenci	Detroit Copper Mining Co	Blister.
Sasco	Southern Arizona Smelting Co	Do.
California:		
Campo Seco	Penn Chemical Works	Matte.
Winthrop	Bully Hill Copper Mining and Smelting Co.	Do.
Coram	First National Copper Co	Blister.
Kennett	Mammoth Copper Mining Co	Do.
Martinez	Mountain Copper Co	Do.
Do	General Chemical Co. of California [a]	Matte.
Needles	Needles Smelting and Refining Co.[b]	Do.
Selby	Selby Smelting and Lead Co.[c]	Lead furnace matte.

[a] Formerly Peyton Chemical Co.
[b] Formerly Arizona-Mexican Mining and Smelting Co
[c] Subsidiary of American Smelters Securities Co.

Smelting plants that treated copper-bearing materials from the United States in 1909—Continued.

Location.	Company.	Final copper product.
UNITED STATES—contd.		
Colorado:		
Denver	American Smelting and Refining Co	Lead furnace matte.
Do	Boston and Colorado Smelting Co	Matte.
Durango	American Smelting and Refining Co	Lead furnace matte.
Leadville	do	Do.
Pueblo	do	Do.
Salida	Ohio and Colorado Smelting and Refining Co.	Do.
Utah Junction	Modern Smelting and Refining Co	Matte.
Idaho: Ponderay	Idaho Smelting and Refining Co	Lead furnace matte.
Illinois: Aurora	American Smelting and Refining Co	Matte.
Maryland: Baltimore	Baltimore Copper Smelting and Rolling Co.[a]	Electrolytic.
Michigan:		
Hancock	Lake Superior Smelting Co	Anodes and lake.
Do	Quincy Mining Co	Do.
Houghton	Michigan Smelting Co	Do.
Hubbell	Calumet and Hecla Mining Co	Do.
Missouri: Fredericktown	North American Lead Co	Electrolytic.
Montana:		
Anaconda	Washoe Copper Co	Blister.
Butte	Colusa-Parrot Mining and Smelting Co	Do.
Do	East Butte Copper Mining Co	Do.
East Helena	American Smelting and Refining Co	Lead furnace matte.
Great Falls	Boston and Montana Consolidated Copper and Silver Mining Co.	Blister and electrolytic.
Nebraska: Omaha	American Smelting and Refining Co	Blister.
Nevada: McGill	Steptoe Valley Mining and Smelting Co.	Do.
New Jersey:[b]		
Chrome	United States Metals Refining Co	Electrolytic and casting.
Maurer	American Smelting and Refining Co	Electrolytic.
Newark	Balbach Smelting and Refining Co	Electrolytic and casting.
Perth Amboy	Raritan Copper Works	Electrolytic.
New York:		
Black Rock	Buffalo Smelting Works	Lake and electrolytic.
Laurel Hill	Nichols Copper Co	Electrolytic and casting.
Oregon: Takilma	Elder Mining and Smelting Co	Matte.
Pennsylvania:[b] Carnegie	Pennsylvania Smelting Co	Lead furnace matte.
South Dakota: Hill City	Continental Copper Mining and Smelting Co.	Matte.
Tennessee:		
Copperhill	Tennessee Copper Co	Blister.
Isabella	Ducktown Sulphur, Copper, and Iron Co. (Limited).	Matte.
Texas: El Paso	American Smelting and Refining Co	Do.
Utah:		
Bingham	Yampa Smelting Co	Blister.
Garfield	Garfield Smelting Co.[a]	Do.
Murray	American Smelting and Refining Co	Lead furnace matte.
Ogden	Independent Smelting Co	Matte.
Silver City	Tintic Smelting Co	Lead furnace matte.
Virginia:		
Dumfries	Cabin Branch Mining Co	Matte.
West Norfolk	Virginia Smelting Co	Do.
Washington:		
Everett	Puget Sound Reduction Co.[a]	Lead furnace matte.
Northport	Northport Smelting and Refining Co	Matte.
Tacoma	Tacoma Smelting Co.[a]	Blister.
CANADA.		
British Columbia:		
Ladysmith	Tyee Copper Co. (Limited)	Matte.
Grand Forks	Granby Consolidated Mining, Smelting, and Power Co.	Blister.
MEXICO.		
Aguas Calientes: Aguas Calientes.	American Smelting and Refining Co	Blister.

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[a] Subsidiary of American Smelters Securities Co.

[b] This list does not include a smelter in New Jersey and one in Pennsylvania, both of which make blister from material solely of foreign origin.

Sixty-three plants treated copper-bearing materials from the United States in 1909, as compared with 68 in 1908. Eleven plants that were producers from United States ores in 1908 did not produce in 1909. Most of these were small matte smelters, in several cases remote from railroad facilities and unable to operate under the conditions of 1909. Two foreign smelters treated custom ores from the United States in 1908 and not in 1909. Six plants produced in 1909 and not in 1908, of which 4 were small matte smelters that had not been previously operated, and 2 were foreign smelters.

The figures of production represent the actual smelter recovery. For Michigan it is the sum of furnace-refined copper and the copper cast into anodes for electrolytic refining. In the case of blister copper the figures represent the fine copper content. A small quantity of electrolytic copper was produced without passing through the intermediate stage of blister copper, and some casting copper was produced direct from ore and matte. Both of these are included in the smelter production.

The following table shows approximately the production of blister copper from different sections. Smelters that produced only matte are not included in this distribution:

Production of copper in 1909, apportioned according to locality in which smelted to blister, in pounds.

Locality.	Domestic.	Foreign.	Total.
Arizona	291,050,994	25,824,208	316,875.202
Montana	317,372,845		317,372,845
Utah and Nevada	147,466,510		147,466,510
California and Washington	52,984,745	12,334,998	64,230,041
All others	275,138,088	47,891,366	324,119,156
Total by domestic plants	1,084,013,182	86,050,572	1,170,063.754
Total by foreign plants	8,938,442		
Grand total from domestic ores	1,092,951,624		

As will be seen by comparing this table with the table showing the production by States and districts, ore, with few exceptions, is reduced to blister copper before being shipped from the district. The exceptions in the case of important producing States are Michigan and Colorado. In the case of Michigan the shipping product is high-grade concentrate transported by Lake boats to Buffalo at a low cost; in the case of Colorado the copper is largely produced in lead furnaces and is shipped to Omaha for conversion.

Arizona treated considerable Mexican ore, and ore and matte from British Columbia were treated in this country. Considerable matte from the United States was smelted in Mexico, and ore from the United States was smelted in British Columbia and returned to this country. A large tonnage of ore and matte from foreign sources was treated by the seaboard smelters.

The following table distributes the production according to the locality where first smelted. It differs from the preceding table in that it excludes from the blister smelters all copper derived from custom matte and includes the product of matte smelters derived from domestic ores:

Copper produced from domestic ore and concentrates in 1909, apportioned according to locality in which first smelted, in pounds.

Arizona and Texas	296,266,102
California	54,464,298
Colorado	10,803,389
Michigan	171,355,411
Montana	317,013,034
Missouri, Nebraska, Illinois, and South Dakota	4,709,550
Tennessee	19,248,801
Utah and Nevada	151,528,302
Oregon, Washington, and Canada	8,950,928
New York, New Jersey, Pennsylvania, Maryland, North Carolina, and Virginia	57,510,694
Total	1,091,850,509

It will be seen by comparing this table with that giving the production by States that there is a very close correspondence. No large copper-producing camps of this country in 1909 shipped their ore or concentrates to any great distance from the mines before smelting at least to matte. Several of the smaller camps, however, have only matte smelters, this product being shipped for further treatment. Matte smelters produced about 45,100,000 pounds of copper during 1909, a marked increase over about 36,500,000 pounds in 1908.

It will be noted that the total in this table is smaller than that in the preceding table, showing the production by blister smelters. This difference is due to the fact that more matte was converted than was produced by the matte smelters during the year. The corresponding figures for 1908 showed an excess of matte, and the opposite would normally occur for the following year.

MINE RETURNS.

The figures of mine production are based on reports furnished to the United States Geological Survey by all mines producing copper in 1909. These mines reported 1,126,521,126 pounds of copper, or 33,569,502 pounds more than the smelters. The mines and smelters of the large copper producers are, with few exceptions, under the same management and are reported on the same basis. In the case of mines that ship to custom smelters or have only matting furnaces and ship their matte for conversion there is likely to be considerable discrepancy, as the mines may report a considerable quantity that has not reached the stage of blister by the close of the year and is consequently not included in the smelter production. This discrepancy is more pronounced if a marked curtailment of production occurs at the beginning or at the close of the year, so that there is not the balance of overlap that occurs if the industry is in normal condition throughout the year. A number of small operators report the copper in their ores on the basis of commercial assay. Considerable copper is also recovered by the smelters from ores that are treated primarily for other metals, the copper content being so low that it is not paid for, and consequently is not always reported by the mines.

During 1909 there were large additions made to the stocks of ore and concentrates. These additions were especially important in

Arizona and Michigan, but there were also important additions in Utah, Nevada, and other States. These additions to stocks very nearly account for the difference between the mine and the smelter reports.

PRODUCTION BY STATES.

Twenty-one States and Territories contributed to the copper production of 1909. The following table shows the mine and smelter output of individual States for 1908 and 1909. Several small producing States are grouped to avoid disclosing individual production.

According to smelter returns the three leading copper States, Montana, Arizona, and Michigan, produced 76 per cent of the total output of 1909, as compared with 81 per cent in 1908; the six leading States, including Utah, Nevada, and California, produced over 95 per cent of the total output in 1909.

Production of copper by smelter returns in 1908 and 1909, compared with mine returns for same years, by States, in pounds.

State.	1909.				1908.	
	Production.					
	Rank.	Per centage of total.	Smelter returns.	Mine returns.	Production, smelter returns.	Mine returns.
Alaska	11	0.37	4,057,142	4,124,705	4,438,836	4,585,362
Arizona	2	26.63	291,110,298	303,899,461	289,523,267	285,858,133
California	6	4.90	53,568,708	57,288,281	39,643,835	38,776,881
Colorado	8	1.05	11,485,631	10,922,046	13,943,878	9,997,738
Idaho	9	.65	7,096,132	9,115,489	7,256,086	10,041,850
Massachusetts					7,863	
Michigan	3	20.77	227,005,923	234,136,529	222,289,584	223,286,700
Montana	1	28.81	314,858,291	312,058,011	252,503,651	251,667,795
Nevada	5	4.93	53,849,281	57,976,477	12,241,372	15,598,788
New Mexico	10	.46	5,031,136	5,393,146	4,991,351	6,112,630
North Carolina	18	.01	120,451	224,514	29,391	20,993
Oregon	15	.02	245,403	235,000	271,191	291,377
Tennessee	7	1.76	19,207,747	19,206,806	19,710,103	19,459,501
Utah	4	9.27	101,241,114	108,947,811	71,370,370	86,848,812
Virginia	16	.02	231,971	224,162	25,087	24,775
Washington	17	.01	120,611	255,134	162,201	312,030
Wyoming	14	.04	433,672	492,539	2,416,197	2,452,049
Alabama				122,270	30,488	
South Carolina						
South Dakota	20		41,988			
Texas	21		3,456			
Maryland		.10	1,083,033	698,745	135,139	188,756
New Hampshire	19					
Pennsylvania	13					
Missouri and unapportioned	12	.20	2,159,636	1,200,000	1,316,308	1,299,043
Total			1,092,951,624	1,126,521,126	942,570,721	956,840,578

In the distribution of the blister output to the States of origin it is necessary to have reports not only from blister producers but also from matte smelters, as the matte is credited by the smelter that converts it to the State from which it was received, although the matte smelter may have received its ores from several States. In the adjustment of the products of these matte smelters slight errors in the distribution of the blister production are probably introduced.

In the following table is given the blister copper output of the leading districts of the country:

Blister copper production of principal districts in 1909, in pounds.

District or region.	State.	Approximate smelter output.	Percentage of total production.	Rank.
Butte	Montana	314,000,000	28.73	1
Lake Superior	Michigan	227,000,000	20.77	2
Bisbee	Arizona	130,000,000	11.89	3
Bingham	Utah	86,000,000	7.87	4
Morenci-Metcalf	Arizona	72,000,000	6.59	5
Ely	Nevada	51,700,000	4.73	6
Shasta County	California	48,000,000	4.39	7
Jerome	Arizona	36,700,000	3.36	8
Globe	do	33,000,000	3.02	9
Tennessee	Tennessee	19,200,000	1.76	10
Silverbell	Arizona	10,500,000	.96	11
Coeur d'Alene	Idaho	7,000,000	.64	12
Tintic	Utah	6,000,000	.55	13
Calaveras County	California	5,400,000	.49	14
Leadville	Colorado	5,200,000	.48	15
Lucin	Utah	4,500,000	.41	16
San Juan-Ouray	Colorado	4,300,000	.39	17
Santa Rita	New Mexico	3,300,000	.30	18
Southeastern Alaska	Alaska	2,700,000	.25	19
Total		1,066,500,000	97.58	
All others		26,400,000	2.42	
Grand total		1,092,900,000	100.00	

As shown by the table, 19 districts in 1909, against 21 districts in 1908, produced more than 2,000,000 pounds of blister copper each. The 19 leading districts in 1909 produced over 97 per cent of the copper output of the country; the 21 districts in 1908 produced about the same percentage. In 1909, the 10 leading districts, only one of which reported less than 20,000,000 pounds, produced over 93 per cent of the total output, as compared with 92 per cent for the 10 leading districts in 1908. This shows a continued tendency toward increased output by the large producers and the closing down of small mines.

The following table shows the production for each State for which separate statistics have been kept for the last ten years:

Production of copper in the United States, 1900–1909, by States, in pounds.

State.	1900.	1901.	1902.	1903.	1904.
Alaska				1,339,590	2,043,586
Arizona	118,317,764	130,778,611	119,944,944	147,648,271	191,602,958
California	28,511,225	33,667,456	25,038,724	17,776,756	28,529,023
Colorado [a]	7,826,949	9,801 783	8,422,030	4,158,368	9,506,944
Idaho	290,162	480,511	227,500	778.906	2,158,858
Michigan	145,461,498	156,289,481	170,609,228	192.400,577	208,309,130
Montana	270,738,489	229,870,415	288,903,820	272,555,854	298,314,804
New Mexico	4,169,400	9,629,884	6,614,961	7,300,832	5,368,666
Nevada	407,535	593,608	164,301	[b] 150,000	
South Dakota	15,147	753 510	445,663	173,202	[b] 100,000
Utah	18,354,726	20,116,979	23,939,901	38,302,602	47,062,889
Washington			209,297	80.758	663,694
Wyoming	4,203,776	2,698,712	889,228	1,023,189	3,565,629
Eastern States Southern States Middle States	4,820,495	6,860,039	13,599,047	13,855,612	15,211,086
Lead desilverizers and unapportioned	[b] 3,000,000	531,530	[b] 500,000	[b] 500,000	[b] 100,000
Total	606,117,166	602,072,519	659,508,644	698,044,517	812,537,267

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[a] For several of the early years the production credited to Colorado includes the yield from some ores of uncertain origin which were smelted in Colorado plants.

[b] Based partly on estimates.

Production of copper in the United States, 1900–1909, by States, in pounds—Continued.

State.	1905.	1906.	1907.	1908.	1909.
Alaska	4,900,866	8,685,646	7,034,763	4,438,836	4,057,142
Arizona	235,908,150	262,566,103	256,778,437	289,523,267	291,110,298
California	16,697,489	28,153,202	33,696,602	39,643,835	53,568,708
Colorado [a]	9,404,830	7,427,253	13,998,496	13,943,878	11,485,631
Idaho	7,321,585	8,578,046	9,707,299	7,256,086	7,096,132
Michigan	230,287,992	229,695,730	219,131,503	222,289,584	227,005,923
Montana	314,750,582	294,701,252	224,263,789	252,503,651	314,858,291
New Mexico	5,334,192	7,099,842	10,140,140	4,991,351	5,031,136
Nevada	413,292	1,090,635	1,998,164	12,241,372	53,849,281
Oregon	846,615	545,859	518,694	271,191	245,403
South Dakota	38	....	....	5,471	41,988
Utah	58,153,393	50,329,119	66,418,370	71,370,370	101,241,114
Washington	223,328	290,823	122,263	162,201	120,611
Wyoming	2,530,531	106,177	3,026,004	2,416,197	433,672
Eastern States	15,134,960	21,438	696,102	143,002	1,083,033
Southern States		18,460,210	20,166,822	19,789,598	19,563,625
Middle States		54,347	[b] 1,299,043	[b] 1,580,831	2,159,636
Total	901,907,843	917,805,682	868,996,491	942,570,721	1,092,951,624

[a] For several of the early years the production credited to Colorado includes the yield from some ores of uncertain origin which were smelted in Colorado plants.

[b] Includes "unapportioned."

TONNAGE AND YIELD OF COPPER ORES.

COPPER-BEARING ORES PRODUCED IN 1909.

The following tables show the tonnage and the yield in copper of the ores produced by the mines of the United States in 1909. The figures are taken from the mine reports of the various States, which form a part of the volume on Mineral Resources issued annually by the Geological Survey. As stated in a preceding paragraph, a portion of this output was not smelted during the year; but the close agreement between the output as reported by the mines and the actual recovery of metal by the smelters, when accumulated stocks are considered, leads to the belief that the tenor of ores as reported by the mines is very close to the actual recovery of metal. The classification of some of the complex western ores is a difficult and more or less arbitrary matter. Under copper ores are classed those which contain 2½ per cent or more of copper, as well as those which contain less than this percentage, provided their principal value is in copper. Under copper-lead and copper-zinc ores are classed complex ores in which copper is an important constituent. Considerable copper was reported by the mines from ores mined primarily for other metals, including siliceous gold and silver ores, lead ores, zinc ores, pyritic sulphur ores, and ores concentrated for values in other metals. No attempt has been made to compile tables showing the tonnage and yield of this group of copper-bearing ores. They yielded a total of 12,556,003 pounds of copper, or about 1 per cent of the total output, and 12,272,092 pounds were recovered from old slags, smelter cleanings, etc., and precipitated from mine waters.

Copper produced in 1909 from ores in which copper constitutes the principal value, by States.

State.	Copper ore.	Copper in ore.	Percentage.	Gold in ore.	Silver in ore.	Value in gold and silver per ton.
	Short tons.	*Pounds.*		*Fine ounces.*	*Fine ounces.*	
Alaska	34,669	4,124,705	5.95	2,014.24	22,549	$1.55
Arizona	3,741,713	302,902,732	4.05	40,146.14	1,830,998	.48
California	840,358	57,206,270	3.40	33,430.12	1,539,665	1.78
Colorado	60,673	3,858,020	3.18	21,256.12	1,058,894	16.32
Idaho	97,803	7,965,882	4.07	1,180.26	599,331	3.43
Maryland, New Hampshire,[a] and Pennsylvania	193,066	698,745	.18	335.24	3,493	.05
Michigan	11,429,394	234,136,529	1.02	0.00	286,430	.01
Montana	4,965,001	305,373,499	3.08	38,001.72	10,281,046	1.25
Nevada	1,670,457	57,566,912	1.72	17,689.33	74,618	.24
New Mexico	81,144	4,910,551	3.02	397.80	23,318	.25
North Carolina and South Carolina	3,575	224,512	3.14	72.76	108	6.15
Oregon	1,647	235,000	7.13	227.36	227	2.92
South Dakota	1,875	114,408	3.05	43.30	3,009	1.31
Tennessee	576,680	19,206,806	1.66	168.98	57,637	.06
Texas	10	3,592	17.96	0.00	38	1.98
Utah	4,216,226	104,020,246	1.23	117,265.85	2,500,717	.88
Virginia	13,825	224,162	.81	113.87	4,817	.35
Washington	2,382	190,162	3.99	54.91	12,081	3.11
Wyoming	2,120	492,539	11.61	44.41	1,729	.86
Total and average	27,932,618	1,103,455,272	1.98	272,442.41	18,300,705	.54

[a] Percentage of copper in ore from New Hampshire and Maryland, 2.5.

Copper ores concentrated and smelted, concentrates produced, and copper produced from each class of ore in 1909, by States.

State.	Ores concentrated.	Concentrates produced.	Copper in concentrates.	Per centage of copper from ore.	Ores smelted.	Copper produced.	Percentage.
	Short tons.	*Short tons.*	*Pounds.*		*Short tons.*	*Pounds.*	
Alaska					34,669	4,124,705	5.99
Arizona	1,464,171	485,336	59,811,497	2.04	2,277,542	243,091,235	5.34
California	9,000	1,568	112,854	.62	831,358	57,093,416	3.44
Colorada					60,673	3,858,020	3.18
Idaho	40	10	1,396	1.75	97,763	7,964,486	4.07
Maryland, New Hampshire, and Pennsylvania	191,198	9,801	621,969	.16	1,868	76,776	2.05
Michigan	11,429,394	179,431	234,136,529	1.02			
Montana	4,367,169	1,298,096	246,510,369	2.82	597,832	58,863,130	4.92
Nevada	1,645,833	197,233	54,905,292	1.67	24,624	2,661,620	5.40
New Mexico	68,571	6,105	1,984,567	1.45	12,573	2,925,984	11.63
North Carolina and South Carolina					3,575	224,512	3.14
Oregon					1,647	235,000	7.13
South Dakota					1,875	114,408	3.05
Tennessee					576,680	19,206,806	1.66
Texas					10	3,862	19.31
Utah	3,489,535	152,280	68,243,356	.98	726,691	35,776,890	2.46
Virginia					13,825	224,162	.81
Washington					2,382	190,162	3.99
Wyoming					2,120	492,539	11.61
Total	22,664,911	2,329,860	666,327,829	1.47	5,267,707	437,127,713	4.15

Copper produced from copper-lead and copper-zinc ores in 1909, by States.

State.	Copper-lead and copper-zinc ores.	Copper in ore.	Percentage of copper.
	Short tons.	*Pounds.*	
Arizona	16,810	500,813	1.48
Colorado	9,267	1,576,580	8.50
Missouri	60,278	1,200,000	.99
Montana	610	59,262	4.85
Nevada	1,021	173,092	8.47
New Mexico	25	4,738	9.48
Texas	3	270	4.50
Utah	4,460	528,028	5.92
Total and average	92,474	4,042,783	2.18

Copper derived from ore classed as copper-bearing ores, and total production of copper from all sources, in 1909, by States.

	Total ores.			Copper from all sources, including old slags, smelter cleanings, precipitates, etc.
	Tons treated.	Pounds of copper recovered.	Percentage of copper.	
	Short tons.			*Pounds.*
Alaska	34,669	4,124,705	5.99	4,124,705
Arizona	3,758,523	303,403,545	4.04	303,899,461
California	840,358	57,206,270	3.40	[a]57,288,281
Colorado	69,940	5,434,600	3.88	[b]10,922,046
Idaho	97,803	7,965,882	4.07	9,115,489
Maryland, New Hampshire, and Pennsylvania	193,066	698,745	.18	698,745
Michigan	11,429,394	234,136,529	1.02	234,136,529
Missouri	60,278	1,200,000	.99	1,200,000
Montana	4,965,611	305,432,761	3.08	[c]312,058,011
Nevada	1,671,478	57,740,004	1.73	57,976,477
New Mexico	81,169	4,915,289	3.02	[d]5,393,146
North Carolina and South Carolina	3,575	224,512	3.14	224,514
Oregon	1,647	235,000	7.13	235,000
South Dakota	1,875	114,408	3.05	[e]118,408
Tennessee	576,680	19,206,806	1.66	19,206,806
Texas	13	3,862	19.31	3,862
Utah	4,220,686	104,548,274	1.24	[f]108,947,811
Virginia	13,825	224,162	.81	224,162
Washington	2,382	190,162	4.00	[g]255,134
Wyoming	2,120	492,539	11.61	492,539
Total and average	28,025,092	1,107,498,055	1.98	1,126,521,126

[a] Some copper was produced as precipitate and from siliceous ores.
[b] About 50 per cent of the copper was derived from ores not classed as copper ores.
[c] 6,467,068 pounds of copper was produced as precipitate.
[d] Considerable copper was derived from gold, silver, and other ores not classed as copper ores.
[e] Small amount of copper was recovered from concentrates.
[f] Considerable copper was recovered from lead and other ores.
[g] 64,972 pounds of copper derived from siliceous ores.

TONNAGE.

The output of copper, copper-lead, and copper-zinc ores mined in 1909 was 28,025,092 tons, as compared with 22,358,857 tons in 1908. Of this output, 27,932,618 tons were copper ores and 92,474 tons were copper-lead and copper-zinc ores, as compared with 22,290,886 tons of copper ore and 67,971 tons of copper-lead and copper-zinc ores in 1908. Of the total 27,932,618 tons of copper ore, 5,267,707 tons were smelting ore and 22,664,911 tons were concentrating ores, as compared with 4,665,534 tons of smelting ore and

17,760,522 tons of concentrating ore in 1908. In 1909 copper concentrating ores produced 2,329,860 tons of concentrates, the average concentration being 9.7 into 1 in 1909 as compared with 10.8 into 1 in 1908. Excluding the ores and concentrates from Michigan, 11,235,517 tons of ore produced 2,150,429 tons of concentrates, or a concentration of about 5.6 into 1, which was exactly the rate for 1908.

Michigan, with 11,429,394 tons, or about 41 per cent of the total tonnage, was by far the largest producer of copper ores in 1909, and was followed in order by Montana with about 17 per cent, Utah with over 15 per cent, and Arizona with over 13 per cent. Next in order were Nevada, California, and Tennessee. In concentrating ores the producing States were in the following order: Michigan, Montana, Utah, Nevada, and Arizona.

YIELD.

The 28,025,092 tons of copper, copper-lead, and copper-zinc ores mined in 1909 yielded 1,107,498,055 pounds of copper, or 1.98 per cent, as compared with 2.08 per cent in 1908. If the Michigan output is excluded, the yield of the remaining copper ores was 2.63 per cent for 1909 as compared with 2.98 per cent for 1908. In 1909 copper ores produced 1,103,455,272 pounds of copper, or 1.98 per cent, and copper-lead and copper-zinc ores produced 4,042,783 pounds, or 2.18 per cent.

The 5,267,707 tons of copper ore smelted yielded 437,127,713 pounds of copper, an average yield of 4.15 per cent, as compared with 4.27 per cent in 1908. The 22,664,911 tons of concentrating ore yielded 666,327,829 pounds of copper, or 1.47 per cent, as compared with 1.485 per cent in 1908. Excluding the product from Michigan, which yielded 1.02 per cent in 1909 as compared with 1.06 per cent in 1908, the concentrating ores from the remainder of the United States yielded 1.92 per cent copper in 1909, as compared with 2.10 per cent in 1908.

Among the important copper-producing States, Arizona took the lead in the yield of copper per ton of ore, the average for 1909 being 4.04 per cent; California was second, with a yield of 3.40 per cent; and Montana was third, with 3.08 per cent. Nevada, Tennessee, and Utah followed in the order named.

Of the States producing an important tonnage of smelting ores, Arizona averaged highest in copper per ton of ore, the average yield for the year being 5.34 per cent; Montana was second with a yield of 4.92 per cent; California, Utah, and Tennessee followed with yields of 3.44, 2.46, and 1.66 per cent, respectively.

In the yield per ton of concentrating ores, Montana led with an average of 2.82 per cent, followed by Arizona with 2.04 per cent, Nevada 1.67 per cent, Michigan 1.02 per cent, and Utah 0.98 per cent.

In 1909 copper ores yielded 272,442.41 ounces of gold and 18,300,705 ounces of silver, or 0.00975 ounce of gold and 0.655 ounce of silver per ton, an average precious-metal value of 54 cents per ton. In 1908 copper ores yielded 0.0104 ounce of gold and 0.666 ounce of silver per ton, an average precious metal value of 56 cents per ton.

Exclusive of the Michigan ores, amounting to about 9,780,000 tons, from which silver was not recovered, the average yield for the remaining ores of the United States was 0.015008 ounce of gold and

1.008 ounces of silver per ton, or a combined precious-metal value of 83.4 cents per ton of ore. In 1908 the yield, exclusive of Michigan ores that did not yield silver, was 0.0166 ounce of gold and 1.075 ounces of silver per ton, or a combined precious-metal value of 91 cents per ton of ore.

Exclusive of the Michigan ores that did not yield silver, there was still included considerable ore from which the gold and silver values were not recovered, namely, that producing the casting copper from the Morenci-Metcalf district, Arizona, and from the Ducktown district, Tennessee, and to a slight extent from other districts. This casting copper was not electrolytically refined and consequently the precious metal values were not recovered from it.

Among the important copper-producing States, California was first in the value of gold and silver per ton of ore in 1909, the average being $1.78; Montana followed with $1.25 per ton; Utah with $0.88; Arizona, $0.48; Nevada, $0.24; Tennessee, $0.06; and Michigan, $0.01.

REVIEW BY STATES.

BRIEF STATEMENT.

In the following pages a brief statement of the conditions affecting production in the principal districts is presented and the tenor of ore treated from each district is given when this will not disclose the production of individual companies, the figures of whose output have not already been published in their annual reports or elsewhere. In previous reports it has been customary to summarize briefly the geological occurrence of ores and to cite references to the principal publications dealing with the important districts; on account of the late appearance of the 1909 report for reasons already stated, it has seemed best to omit both occurrences and references, but it is hoped that the 1910 report may again contain these features. Those desiring more detailed information of the mining operations of the several districts are referred to the reports on mine production for the various States which are published by the United States Geological Survey and which, with this and other reports on the metals, form the first part of the volume Mineral Resources of the United States for 1909.

ALASKA.

The blister copper production for Alaska for 1909 was 4,057,142 pounds, as compared with 4,438,836 pounds in 1908.

As in previous years the production was from the Ketchikan and Prince William Sound districts. The ore was all shipped to British Columbia and Washington plants, no smelter being operated in Alaska during the year. Work was continued on the Copper River and Northwestern Railroad, but production from the Copper River district will not begin before 1911.

ARIZONA.

In 1909 Arizona produced 291,110,298 pounds of blister copper as compared with 289,523,267 pounds in 1908. Ten copper smelters contributed to the 1909 output as compared with 8 for 1908, 2 matte smelters, the Arizona Commercial at Globe and the Arizona United at Johnsons, being operated for a portion of the year.

As in previous years the greater part of the production was from four districts.

Bisbee district.—The Bisbee or Warren district, located in southern Cochise County, was the largest producer, with about 130,000,000 pounds of blister copper as compared with 129,000,000 pounds in 1908.

During 1909 the average copper content of ores for the district was slightly above 6 per cent, with low gold and silver values. The annual report of Phelps, Dodge & Co. for 1909 shows that the copper content of ores mined by the Copper Queen Company averaged about 7.3 per cent copper, 1 ounce of silver, and 30 cents in gold per ton. The blister copper output from the mine was 75,869,405 pounds.

The ores treated from the Calumet and Arizona mine gave an average recovery of 4.197 per cent of copper as the ores came from the mine, and there was an average of $15.32 in gold and silver values per ton of refined copper. The mine produced 27,630,050 pounds of copper during the year. The ore from the Superior and Pittsburg mine yielded an average of 4.754 per cent, with a value of $13.50 in gold and silver per ton of refined copper, the mine making an output of 24,325,667 pounds of copper for the year. Besides the mines mentioned, the Shattuck-Arizona mine contributed to the output of the district.

Jerome district.—The Jerome district of Yavapai County produced about 36,700,000 pounds of blister copper in 1909, as compared with about 36,000,000 pounds in 1908. The United Verde mine is the only important producer of the district. Exploration was being carried on in the district by several other companies during 1909.

Morenci-Metcalf district.—The output of blister copper from the Morenci-Metcalf district for 1909 was about 72,000,000 pounds, as compared with 77,000,000 pounds for 1908.

The average yield in copper of concentrating ores was 2.026 per cent and of smelting ores 3.63 per cent, the average yield of all ores treated being 2.29 per cent. About 73.5 per cent of the copper was derived from concentrating ores. The precious metal content of the ores is so low that for much of the output refining the copper electrolytically to recover the precious metals is not found profitable.

The recovery of copper from ores from the Detroit Copper Company's mines was as follows: Concentrating ores, 2.273 per cent; smelting ores, 14.55 per cent; siliceous ores, 5.03 per cent; average recovery from all ores, 2.562 per cent. The mines produced 468,100 tons of ore, yielding 23,991,595 pounds of copper during the year.

As shown by the annual report of the Arizona Copper Company (Limited) for the year ending September 30, 1909, the output of the company's mines at Morenci and Metcalf was 741,068 tons of ore, with an average yield of 42.49 pounds per ton, as compared with a yield of 45.5 pounds in 1908.

The smelter of the Shannon Copper Company for the fiscal year ending August 31, 1910, produced 16,565,032 pounds of copper from company ores and 1,045,233 pounds from custom ores. During the same period the mines of the company yielded 311,456 tons of ore.

Globe district.—The Globe district of Gila County produced about 33,000,000 pounds of copper in 1909, as compared with about 36,000,000 in 1908. By far the largest producer was the combined

Old Dominion and United Globe companies, though the Warrior and the Arizona Commercial companies made important contributions to the output. The ores of the district averaged about 4.43 per cent of copper per ton for 1909, as compared with about 4.5 per cent for 1908.

During 1909 the Arizona Commercial Company erected a matte smelter, which was blown in in October and operated for the remainder of the year, though it ceased operations early in 1910.

There was a large development of the low-grade disseminated ores in the Miami section of the district, about 6 miles west of Globe. The Miami, the Inspiration, the Live Oak, and other companies were engaged in developing this type of deposit. The Miami Company began the erection of a concentrator, but production from disseminated ores will not begin before 1911.

Silver Bell district.—The Silver Bell district made a production of about 10,500,000 pounds of blister copper during 1909. The output was mainly from the mines of the Southern Arizona Copper Company. Prospecting of the disseminated deposits of the district by churn drill was begun during the year and encouraging results were reported.

Turquoise district.—The Turquoise or Courtland district, Cochise County, made a blister production of about 1,000,000 pounds during 1909. At the close of the year the Great Western Copper Company was the only company conducting important operations in the district.

Mineral Creek district.—The only important production in the Mineral Creek district, Pinal County, was from ores treated in the experimental mill of the Ray Consolidated Company. Active development of the disseminated ores was carried on mainly by the Ray Consolidated, the Gila Consolidated, and the Ray Central companies. The former two companies are now consolidated as the Ray Consolidated Copper Company. This company has a concentrator in process of construction at Hayden at the junction of San Pedro and Gila rivers. This, however, will not be completed till 1911. Is it also planned to construct a smelting plant to treat the concentrates.

Santa Maria district.—In the Santa Maria or Bill Williams district, Yuma County, development was continued during 1909, the Planet and the Clara Consolidated companies being most active. The latter company built a blister smelter, which was blown in in 1910.

CALIFORNIA.

The production of blister copper in California for 1909 was 53,568,708 pounds as compared with 39,643,835 pounds for 1908, an increase of 13,924,873 pounds. The output, as in previous years, was principally from the Shasta County belt, and the increased production was from this district.

Shasta district.—The Shasta district produced about 48,000,000 pounds of blister copper in 1909, as compared with about 32,500,000 pounds in 1908.

The average metallic content of the copper ores treated from the district during 1909 was copper 3.4 per cent, silver 1.92 ounces, valued at $0.998 per ton; gold 0.049 ounce, valued at $1.02 per ton; a total precious-metal value of about 3 cents per pound of copper.

Three smelters were operated in the district during the year; the Mammoth smelter of the Mammoth Copper Mining Company, at Kennett; the Balaklala smelter of the First National Copper Company, at Coram; and the Bully Hill smelter of the Bully Hill Copper Mining and Smelting Company, at De Lamar. The output of the Mountain Copper Company's mines was treated at its Martinez plant on San Francisco Bay.

"*Foothill Copper Belt.*"—The only other district making an important production in 1909 was that known as the "Foothill Copper Belt," whose greatest development is in Calaveras County. The ores of this district yielded in 1909 about 4.6 per cent copper, with a precious-metal value of about 2.5 cents per pound of copper.

COLORADO.

In 1909 Colorado produced 11,485,631 pounds of blister copper, as compared with 13,943,878 pounds in 1908. The State contains no large producing district in which copper is the principal metal, most of the production being incidental to the recovery of other metals. The largest production, as in 1908, was from Lake County and from San Juan, Hinsdale, Ouray, San Miguel, and Gilpin counties.

IDAHO.

During 1909 Idaho produced 7,096,132 pounds of blister copper, as compared with 7,256,086 pounds in 1908. As in 1908 most of the output of the State was from the Snowstorm mine in the Coeur d'Alene district. The ore being highly siliceous is well adapted for converter linings and is shipped to smelters in Montana, Utah, California, Washington, and British Columbia.

MICHIGAN

The smelter production of copper in Michigan in 1909 was 227,005,923 pounds, as compared with 222,289,584 pounds for 1908. The smelter output was smaller than the mine production as considerable mineral produced was not smelted. The entire production comes from the Keweenaw Peninsula, which embraces parts of Houghton, Keweenaw, and Ontonagon counties.

The most important developments in the district during the year were in Ontonagon County, where encouraging results were obtained in the development of the Lake mine and adjacent properties.

The production of individual mines for 1908 and 1909 is shown in the following table; the last eight are grouped in order that figures that have not already been published by the companies shall not be disclosed:

Smelter production of copper in Michigan in 1908 and 1909, by companies, in pounds.

Company.	1908.	1909.
Adventure	90,870	...
Allouez	3,047,051	4,031,532
Baltic	17,724,854	17,817,836
Centennial	2,196,377	2,583,793
Champion	17,786,763	18,005,071
Franklin	3,707,518	1,615,556
Isle Royale	3,011,664	5,719,056
Mass	1,766,930	1,723,436
Michigan	3,000,206	1,979,305
Mohawk	10,295,881	11,248,474
Osceola	21,250,794	25,296,657
Quincy	20.600,361	22,511,984
Tamarack	12,806,127	13,533,207
Trimountain	6,034,908	5,282,404
Victoria	1,290,040	1,062,218
Wolverine	9,555,233	...
Ahmeek, Arnold, Atlantic,[a] Calumet and Hecla, Lake, La Salle,[a] Superior,[a] and Wolverine	88,124,007	94,595,394
Total	222,289,584	227,005,923

[a] Did not produce in 1908.

The average yield in copper per ton of rock milled during 1909 was 20.5 pounds, as compared with 21.2 pounds for 1908. This brings the average for the district very nearly down to 1 per cent. The average copper recovery from conglomerate rock for 1908 was about 28.7 pounds per ton and for amygdaloid 17.7 pounds per ton. The copper derived from the two types, respectively, was about 35 and 65 per cent.

During 1909 the rock milled amounted to 11,429,394 tons, as compared with 10,502,606 tons for 1908, an increase of 926,788 tons.

The change in grade of ore handled by the Lake companies is shown in the following table. The figures published for individual companies have already appeared in their annual reports or elsewhere.

Tonnage and yield of ore milled by principal Michigan companies in 1908 and 1909.

Company.	1908.		1909.	
	Tonnage.	Yield per ton.	Tonnage.	Yield per ton.
	Short tons.	*Pounds.*	*Short tons.*	*Pounds.*
Allouez	220,905	13.79	253,049	15.93
Baltic	764,117	23.20	814,260	21.88
Centennial	169,693	12.94	196,525	13.15
Champion	794,703	22.39	753,908	23.88
Franklin	342,596	10.82	170,546	9.47
Isle Royale	218,940	13.75	401,280	14.30
Mass	171,268	10.31	139,404	12.36
Michigan	190,548	15.74	146,971	13.47
Mohawk	685,823	15.01	819,019	13.73
Osceola	1,241,400	17.11	1,494,845	16.90
Tamarack	654,897	19.55	689,099	19.60
Trimountain	334,929	18.02	323,408	16.33
Wolverine	360,055	26.54	380,264	26.22
Adventure, Ahmeek, Calumet and Hecla, Quincy, and Victoria	4,264,217	25.47	4,846,816	23.29

MONTANA.

The output of blister copper for Montana in 1909 was 314,858,291 pounds, as compared with 252,503,651 pounds in 1908. This is the largest output ever made by the State, exceeding the 1905 output of 314,750,582 pounds by 107,708 pounds. This again gives Montana first rank among the copper-producing States, a place lost to Arizona in 1907 and 1908.

Butte district.—The Butte district in Silver Bow County furnished practically the entire output. The average yield in copper of the ores of the district for 1909 was about 3.08 per cent, as compared with 3.3 per cent for 1908. In 1909 smelting ores, averaging 4.9 per cent copper, furnished about 19 per cent of the output derived from ores, and concentrating ores, averaging 2.8 per cent, furnished about 81 per cent. The ores averaged 0.207 ounce of silver per ton and 0.0076 ounce of gold, the precious metals reducing the cost of copper about 2 cents per pound. Considerable copper was also recovered from mine waters and from old slags.

NEW MEXICO.

The production of blister copper in New Mexico in 1909 was 5,031,136 pounds, as compared with 4,991,351 pounds in 1908.

Santa Rita-Hanover district.—The deposits of the Santa Rita district made an output of about 3,300,000 pounds blister copper in 1909, as compared with 4,000,000 pounds in 1908.

During the year a large tonnage of ore was developed in the district by the Chino Copper Company, mostly by churn drill methods. According to the company's report the ore developed at the close of the fiscal year ending May 31, 1910, amounted to 18,798,000 tons of an average copper content of 2.59 per cent. A mill is in process of construction at Hurley, about 9 miles from the mines, but important production will not begin before the middle of 1911.

Burro Mountain district.—The Burro Mountain district made but a small production in 1909. The property of the Burro Mountain Copper Company was acquired by Phelps, Dodge & Co. during the year and development work was actively carried on. By the close of the year some 2,000,000 tons of ore were exposed in such a manner as to afford strong mining probabilities that much larger areas of ore-bearing ground exist.

NEVADA.

The production of blister copper in Nevada in 1909 was 53,849,281 pounds, as compared with 12,241,372 pounds in 1908. The large increase is due to the output from the Ely district.

Ely district.—The Ely district, White Pine County, made a production of about 51,700,000 pounds of blister copper, as compared with about 9,400,000 pounds for 1908.

The ores of the district mined during 1909 yielded 1.72 per cent copper in concentrates and a combined gold and silver value of 24 cents per ton.

The following table shows the results of the operations of the Nevada Consolidated Copper Company for the fiscal year ending September 30, 1910:

Results of Nevada Consolidated Copper Company's operations for fiscal year 1910.

Ore treated (dry) short tons	2,237,028
Average copper assay per cent	2.06
Extraction of copper do	69.59
Ratio of concentration	10.6 to 1
Assay value in gold ounces	.0181
Assay value in silver do	.0879
Extraction of gold per cent	49.78
Extraction of silver do	48.36
Average gold and silver recovered per ton of ore cents	21.14
Average copper in concentrates per cent	15.21

TENNESSEE.

In 1909 Tennessee produced 19,207,747 pounds of blister copper, as compared with 19,710,103 pounds in 1908. In 1909 the ores of the State yielded about 33 pounds of blister copper per ton, or 1.66 per cent, with an average of 0.34 cents in gold and silver per pound of copper that was treated electrolytically.

The ore treated by the Tennessee Copper Company contained an average copper content of 39.4 pounds per ton, of which 32 pounds, or 81.2 per cent, was recovered.

Both the Tennessee Copper Company and the Ducktown Sulphur, Copper, and Iron Company operated sulphuric acid plants during 1909.

UTAH.

Utah produced 101,241,114 pounds of blister copper in 1909, as compared with 71,370,370 pounds in 1908. The principal production for 1909 was from the Bingham district.

Bingham district.—The blister copper output of the Bingham or West Mountain district, Salt Lake County, in 1909 was about 86,000,000 pounds, as compared with about 56,000,000 pounds in 1908. The output was derived from two types of ores, smelting ores from the contact deposits and concentrating ores from the disseminated deposits. Smelting ores yielded about 27.5 per cent of the output, the average copper recovery being about 2.23 per cent. Concentrating ores, with an average copper recovery of about 1 per cent, yielded 72.5 per cent of the output.

The Garfield mills of the Boston Consolidated and the Utah Copper companies and the Copperton mill of the latter company treated the concentrating ores from the district. The ores and concentrates of the district were smelted at the Garfield and the Yampa smelters. During the latter part of the year the Yampa smelter produced matte which was shipped to Garfield for further treatment. The Tooele smelter of the International Smelting and Refining Company, at Tooele, was in process of construction.

The Utah Copper Company was the largest producer, with an output of 51,749,233 pounds of copper. The Boston Consolidated Copper Company for the fiscal year ending September 30, 1909, produced 15,543,182 pounds of copper. Smelting ore to the amount of 69,375 tons yielded 3,004,115 pounds of copper, or 2.16 per cent. Concentrating ore to the amount of 640,742 tons was treated at the mill and gave a mill recovery of 13,704,243 pounds, or an average recovery of 70.38 per cent on an ore with an average assay content of 1.519 per cent copper.

The Utah Consolidated Copper Company produced 280,637 tons of ore, yielding 10,043,900 pounds of the fine copper, 298,167 ounces of silver, and 21,569.09 ounces of gold.

The first unit of the Ohio Copper Company's mill was placed in operation late in the year.

Tintic district.—The Tintic district in Juab County made a copper production of about 6,000,000 pounds in 1909, as compared with about 5,700,000 pounds in 1908. As in previous years, the largest copper producer was the Centennial-Eureka mine.

Frisco district.—Only a small production was made from this district. The Cactus mill was idle for the greater part of the year. The total output for the district was about 1,200,000 pounds.

Lucin district.—The production from the Lucin district, Boxelder County, was principally from the Copper Mountain mine of the Salt Lake Copper Company.

OTHER STATES.

Missouri.—As in 1908, the North American Lead Company, at Fredericktown, Madison County, was the only producer of copper in the State.

New Hampshire.—The New Hampshire production was from the mines of the Milan Mining and Milling Company, Coos County.

North Carolina.—The production from North Carolina was from the Virgilina district in Person and Granville counties, the Gold Hill district, Rowan County, and the Cullowhee district, Jackson County.

Oregon.—Oregon in 1909 produced 245,403 pounds of blister copper. The output was mainly from Josephine County.

Pennsylvania.—The Pennsylvania output of copper was derived from concentrates from the iron mines of Lebanon County.

South Dakota.—South Dakota made a blister copper production of 41,988 pounds. The principal producer was the Continental Copper Mining and Smelting Company, Hill City, Pennington County. A small furnace was operated for a short period and a portion of the matte produced was shipped for further treatment.

Virginia.—Virginia made a production of 231,971 pounds in 1909, as compared with 25,087 pounds in 1908. The production was from the Virgilina district and from the Dumfries district, Prince William County.

Washington.—The blister production from Washington was 120,611 pounds in 1909, as compared with 162,201 pounds in 1908. The principal production was from the Northport Smelting and Refining Company, and custom ore was treated by the Tacoma smelter.

Wyoming.—Wyoming produced 433,672 pounds of blister copper in 1909, as compared with 2,416,197 pounds in 1908. The marked decrease is due to the fact that the Penn-Wyoming Copper Company of the Encampment district, Carbon County, was idle throughout the year.

REFINERY PRODUCTION.

The refinery output of the United States was made by 13 plants, 9 of which employ the electrolytic method, and 5 employ the furnace process on Lake Superior copper, the Buffalo plant employing both the electrolytic and the furnace refining method. Six of the large electrolytic refineries are located on the Atlantic tide water; the 5 Lake refineries are all located on the Great Lakes, 4 in Michigan and 1 in New York; and the remaining refining companies are located at Great Falls, Mont., and Fredericktown, Mo. In addition to these refineries, there are numerous plants located in different parts of the country that make a considerable output from old copper, brass, and other alloys of copper.

The output of the regular refining plants is in the form of casting, Lake, and electrolytic copper.

CASTING COPPER.

Blister copper that is low in precious metals and sufficiently free from impurities for certain uses is refined by the furnace process and ordinarily cast into ingots. This copper is usually unfit for the uses requiring a high-grade copper, such as electric transmission, brass manufacture and rolling, but is suitable for copper castings, and a large part of it is put to that use. A comparatively small percentage of the copper output, except that from the Lake district, carries such low values in precious metals that when the increased cost of the electrolytic process is added these values will not more than pay for the electrolytic refining of the copper; consequently the output of casting copper is comparatively small.

Moreover, some blister copper low in precious metals is exported without further treatment and is probably consumed without electrolytic refining. In the following table this is included with casting copper. A large percentage of the casting copper, as shown in the table, is from the Morenci-Metcalf district, Arizona, and from the Ducktown district, Tennessee. Both districts produce a rather high grade of blister carrying low values in precious metals, and it is found profitable to market much of it without electrolytic refining. During 1909 the production of new casting copper amounted to 62,120,667 pounds, 59,750,088 pounds being of domestic origin and 2,370,579 pounds of foreign origin.

LAKE COPPER.

By Lake copper as used in this report is meant the output of the Lake smelters. Considerable of this output is electrolytically refined, but most of the electrolytically refined Lake copper is mixed with furnace-refined copper or sold as some brand of Lake copper. Of the 227,005,923 pounds of copper produced by the Lake smelters, 31,500,113 pounds were electrolytically refined, either to free it from impurities or to recover the silver content.

ELECTROLYTIC COPPER.

Under electrolytic copper as shown in the following table is included all new copper that was electrolytically refined, except that from the Lake district. In 1909 the production of electrolytic copper from primary materials of domestic origin amounted to 778,808,910 pounds, and that of foreign origin to 323,085,954 pounds. Electrolytic copper from secondary sources to the amount of 7,667,662 pounds was produced, making a total electrolytic production for the year of 1,109,561,526 pounds.

SECONDARY COPPER.

Under secondary copper is considered material recovered from remelting of old copper, copper scraps, etc., and copper recovered from the treatment of copper alloys or alloys that are treated without the separation of the copper. One hundred and fourteen plants reported to the Geological Survey as making a production from secondary sources. Though a more systematic canvass of secondary plants was made for 1909 than has been previously done, it is probable that the amount of secondary copper recovered exceeds that reported.

For 1909 there was reported as recovered from remelting of old copper, copper clippings, etc., 42,041,464 pounds; recovered from alloys, 8,751,106 pounds; and 54,693,803 pounds of old brass was remelted, which, on the assumption that the brass carried 70 per cent copper, would have a copper content of 38,285,662 pounds. The total recovery of copper reported from secondary sources is, therefore, about 89,078,232 pounds. Of this total 14,598,065 pounds was recovered by the regular refining companies, 7,667,662 pounds being electrolytically treated, and 74,848,167 pounds was recovered by plants treating secondary materials exclusively.

As contrasted with lead and zinc, the uses for which copper is principally employed are such that a large percentage of the metal can be eventually recovered and returned to the trade. If sufficient data were available, it might be possible to estimate the average period between the time when new copper goes into the trade and the time when it is returned as secondary copper. Any such estimate at the present time would be without value. It is safe to say, however, that the increase in the recovery of secondary copper will bear a ratio to the increase in consumption in the past, and that this recovery must be considered as an important and constantly increasing factor in the copper industry. The production of secondary copper in 1909 was equal to between 12 and 13 per cent of the domestic consumption of new copper, and probably equaled the total domestic consumption of copper for 1886 and 1887.[a]

Some of the secondary material is of foreign origin, so that a comparison with domestic consumption is not entirely justifiable.

TOTAL REFINED COPPER.

The total production of new refined copper for 1909 was 1,391,021,454 pounds, the largest output in the history of the industry, exceeding the 1908 output of 1,137,962,408 pounds by 253,059,046 pounds.

The production of electrolytic, Lake, and casting copper from primary sources for 1908 and 1909 is shown in the following table:

Production of refined copper from primary sources in 1908 and 1909, in pounds.

	1908.		1909.	
	Domestic origin.	Foreign origin.	Domestic origin.	Foreign origin.
Electrolytic	629,392,864	218,716,268	778,808,910	323,085,954
Lake	222,289,584		227,005,923	
Casting	67,428,966	134,726	59,750,088	2,370,579
Total	919,111,414	218,850,994	1,065,564,921	325,456,533
Total output, domestic refineries	1,137,962,408		1,391,021,454	

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[a] Mineral Resources U. S. 1887, U. S. Geol. Survey, 1888, p. 83.

The figures for Lake copper for 1909 include 31,500,113 pounds of Lake copper that was electrolytically refined; those for 1908 include 26,786,485 pounds. A small amount of Lake copper was refined at an eastern refinery in 1909 and was placed on the market as electrolytic copper. Casting copper for both years included blister copper that was exported without refining.

If to the 1,391,021,454 pounds produced from primary sources the 14,598,065 pounds recovered from secondary sources is added, the output of the regular refining plants is seen to be 1,405,619,519 pounds. If to this is added the 74,848,167 pounds recovered as copper and copper alloys by plants treating exclusively secondary material, the contribution of the United States plants to the world's supply of copper is found to be 1,480,467,686 pounds, or 78 per cent of the world's output for 1909.

During 1909 reports of the monthly output of marketable copper from regular refining plants in the United States were made by the Copper Producers' Association. The following table shows the monthly output and the total for the year:

Monthly output of marketable copper as reported by the Copper Producers' Association.

Month.	Output.	Month.	Output.
January	112,135,200	August	120,597,234
February	103,700,817	September	121,030,877
March	117,058,661	October	124,657,709
April	113,574,292	November	121,618,369
May	118,356,146	December	117,828,655
June	116,567,493		
July	118,277,603	Total	1,405,403,056

COPPER SULPHATE.

The production of copper sulphate or bluestone by the refineries of the United States in 1909 was 30,980,729 pounds having a copper content of 7,838,123 pounds, as compared with about 38,240,211 pounds having a copper content of about 9,674,733 pounds in 1908.

STOCKS.

Returns from all smelting and refining companies show that the following stocks of electrolytic, Lake, and casting copper were on hand at the beginning and end of the year 1909:

Stock of refined copper in 1909, in pounds.

January 1, 1909	121,876,759
January 1, 1910	141,486,244
Stocks increased during 1909	19,609,485

In addition to the stocks of refined copper there was at smelters, in transit to the refineries, and at the refineries, blister copper and material in process of refining to the amount of 234,013,843 pounds, January 1, 1909, and of 266,754,808 pounds, January 1, 1910.

During 1909 the Copper Producers' Association reported the stock of marketable copper held at all points in the United States on the first of each month. The following table shows the stocks held at the close of each month:

Stocks of marketable copper of all kinds on hand at all points in the United States on the first day of each month for 1909 and on January 1, 1910, as reported by the Copper Producers' Association, in pounds.

January 1, 1909	122, 357, 266
February 1, 1909	144, 130, 045
March 1, 1909	173, 284, 248
April 1, 1909	182, 279, 902
May 1, 1909	183, 198, 073
June 1, 1909	169, 848, 141
July 1, 1909	154, 858, 061
August 1, 1909	122, 596, 607
September 1, 1909	135, 196, 930
October 1, 1909	151, 472, 772
November 1, 1909	153, 509, 626
December 1, 1909	153, 003, 527
January 1, 1910	141, 766, 111

IMPORTS AND EXPORTS.

IMPORTS.

The quantity of copper in unmanufactured form imported into the United States in 1909 was 321,801,114 pounds, according to the records of the Bureau of Statistics of the Department of Commerce and Labor. The imports in 1908 were 218,705,487 pounds. The following table shows the character and source of copper-bearing materials imported during 1908 and 1909:

Imports of copper into the United States in 1908 and 1909, by countries, in pounds.

Country.	Ore.	Matte and regulus.	Ore, matte, and regulus.	Pigs, bars, ingots, plates, old, etc.	
	1908.	1908.	1909.	1908.	1909.
United Kingdom				5, 434, 435	26, 527, 574
France				168, 506	490, 191
Germany				1, 451, 370	1, 045, 647
Other Europe				13, 359, 117	27, 379, 175
British North America	8, 326, 728	2, 859, 969	9, 689, 829	30, 895, 737	29, 196, 351
Mexico	15, 775, 626	128, 066	23, 914, 040	43, 742, 993	76, 119, 724
Cuba				349, 560	104, 182
Other West Indies and Bermuda				184, 490	223, 408
Peru	9, 054, 852		20, 987, 197	23, 646, 921	32, 344, 009
Other South America				2, 418, 672	5, 369, 667
Japan				8, 329, 896	23, 830, 141
Other countries	15, 652, 830	4, 683, 272	26, 496, 327	32, 242, 447	18, 083, 653
Total	48, 810, 036	7, 671, 307	81, 087, 393	162, 224, 144	240, 713, 722
Grand total				218, 705, 487	321, 801, 115

In 1909 ore to the amount of 362,766 tons, with a copper content of 58,196,535 pounds, and 30,764 tons of matte and regulus, with a copper content of 22,870,858 pounds, were imported. Of the copper imported as matte and blister 8,938,442 pounds was derived from copper ores or matte that had been exported and treated in foreign smelters, leaving 312,862,672 pounds derived from foreign materials. According to the report of the smelters and refiners, 325,456,533 pounds of new copper was produced in this country from foreign material, a difference of 12,593,861 pounds between the amount reported by the smelters and refiners as treated, and that reported by the Bureau of Statistics as imported.

The following table shows imports for consumption:

Imports for consumption, 1909, in pounds.

Ore, copper content	58,159,894
Matte, copper content	22,108,492
Copper, unmanufactured regulus, etc	478,960
Copper, old, fit for remanufacture	2,793,835
Copper, plates, bars, etc	240,802,946
Total	324,344,127

EXPORTS.

The exports of metallic copper from the United States in 1909 amounted to 682,846,726 pounds, according to the Bureau of Statistics. This is the largest export made in any year, exceeding that of 1908 (661,876,127 pounds) by 20,970,599 pounds. In addition to the exports of metallic copper, the copper content of 59,880 long tons of ore, matte, and regulus was exported in 1909, as compared with the content of 63,149 long tons in 1908.

Exports of domestic copper from the United States in 1908 and 1909, by countries.

Country.	Ore, matte, and regulus (gross weight in long tons).		Ingots, bars, plates and old (pounds).	
	1908.	1909.	1908.	1909.
United Kingdom	168	258	117,810,314	156,511,113
Belgium			5,560,366	6,016,861
France			115,690,381	99,003,962
Germany	2		137,453,392	138,213,290
Italy			25,512,267	26,386,069
Netherlands			195,562,619	204,378,211
Russia			4,657,077	3,519,216
Other Europe			39,433,674	41,661,979
British North America	55,367	50,571	3,977,142	6,790,410
Mexico	7,060	8,531	35,895	46,287
Chinese Empire			13,735,899	
Other countries	552	520	2,447,101	319,329
Total	63,149	59,880	661,876,127	682,846,726

The report of the Copper Producers' Association, which is based on a slightly different period, shows a delivery for export of 680,942,620 pounds.

The most important changes since 1908 are the increased export to the United Kingdom, the decreased export to France, and failure of export to China during 1909.

CONSUMPTION.

The apparent consumption of refined new copper in the United States in 1909 was about 688,500,000 pounds, as compared with about 480,000,000 pounds in 1908. The method employed in determining the amount of copper retained for domestic consumption is shown in the following table. It does not take into consideration stocks of copper held by consumers.

The following table shows the apparent consumption of refined new copper in the United States in 1908 and 1909:

Domestic consumption of refined new copper in 1908 and 1909, in pounds.

	1908.	1909.
Total refinery output	1,137,962,408	1,391,021,454
Stock at beginning of year	125,745,796	121,876,759
Total available supply	1,263,708,204	1,512,898,213
Refined copper exported	[a] 661,876,127	[a] 682,846,726
Stock at end of year	121,876,759	141,486,244
Total withdrawn from supply	783,752,886	824,332,970
Apparent consumption	479,955,318	688,565,243

[a] Exports of pigs, bars, ingots, plates, etc., reported by the Bureau of Statistics.

If the 14,598,065 pounds of scrap copper produced by the regular refining companies is added to the output from primary sources, it is found that these plants delivered to domestic consumers 703,163,308 pounds of copper. If to this amount the 74,848,165 pounds recovered as copper and in alloys by plants treating secondary metals exclusively be added, it is found that a total of 778,011,473 pounds of new and old copper was available for domestic consumption.

The following table shows the monthly deliveries of copper for domestic consumption as reported by the Copper Producers' Association:

Monthly deliveries of copper, in pounds, for domestic consumption and for export reported by the Copper Producers' Association.

Month.	Domestic consumption.	Export.
January	51,862,624	38,499,797
February	43,578,118	30,968,496
March	48,871,964	59,191,043
April	47,546,010	65,110,111
May	61,163,325	70,542,753
June	60,591,116	70,966,457
July	75,520,083	75,018,974
August	59,614,207	48,382,704
September	53,567,153	51,187,882
October	66,359,617	56,261,238
November	66,857,873	55,266,595
December	69,519,501	59,546,570
Total	705,051,591	680,942,620

It may be noted that the difference in domestic deliveries as shown by the reports of the Copper Producers' Association and those calculated above for the refining plants is due to the fact that the figures of export as reported by the Bureau of Statistics and the Producers' Association do not agree exactly. The cause of this difference is stated under the discussion of exports.

About 49 per cent of the copper produced from ore mined in the United States was exported. This compares with 48 per cent for 1908 and 41 per cent for 1907.

USES.

No systematic attempt has been made to ascertain the proportion of the copper output of 1909 used in different industries, as electric transmission, brass manufacture, casting, etc. Some idea, however, of the quantities entering the different industries can be gained from the forms in which the output of the refineries was cast. The following table shows the approximate quantity of copper cast in the different forms during 1909 as reported by the refining companies. It will be noted that the total does not equal the refinery output of copper for 1909.

Forms in which copper was cast in 1909, in pounds.

Form.	Total.	Percentage.
Wire bars	631,865,318	46
Ingots and ingot bars	349,737,247	25
Cakes	134,940,141	10
Cathodes	222,494,135	16
Other forms	46,151,578	3
Total	1,385,188,419	100

It may be assumed that a large portion of the 46 per cent cast as wire bars was used for electrical purposes and that the 10 per cent cast as cakes was used largely for rolling. The other forms are less easily classified. The 16 per cent cast as cathodes, together with a portion of the ingots, entered the brass industry, and a large quantity of copper ingots was used in casting. The refinery output for 1908 was cast as follows: Wire bars, 47 per cent; ingots, 26 per cent; cakes, 12 per cent; cathodes, 12 per cent; other forms, 3 per cent.

PRICES.

The average yearly quoted price of electrolytic copper at New York in 1909 was 12.98 cents per pound. In 1908 the price was 13.2 cents per pound. The average monthly prices for electrolytic copper in 1908 and 1909 are given in the following table:

Monthly prices per pound of copper in 1908 and 1909, in cents.

Month.	Price of electrolytic copper, in cents.	
	1908.	1909.
January	13.72	13.893
February	12.90	12.949
March	12.70	12.387
April	12.74	12.562
May	12.60	12.893
June	12.67	13.214
July	12.70	12.880
August	13.46	13.007
September	13.38	12.870
October	13.35	12.700
November	14.13	13.125
December	14.11	13.298
Average	13.20	12.982

The average yearly price of Lake copper was 13.335 cents. These quoted prices are the basis on which much of the copper is sold by the mines and are used by the United States Geological Survey in calculating the value of both mine and smelter output. It is well known, however, that this average yearly price only approximates the actual average price received for copper sold during the year.

WORLD'S PRODUCTION.

The smelter production of copper in the world was 1,875,584,624 pounds in 1909, as compared with 1,683,095,140 pounds in 1908. In 1909 the smelter output of the United States was 58.22 per cent of the world's production, as compared with 56.54 per cent in 1908 and with 54.66 per cent in 1907.

The following table shows the world's production, by countries. The figures are those compiled by Henry R. Merton & Co. (Limited), of London, reduced to pounds, except that the official figures of the United States production are inserted.

World's production (smelter output) of copper in 1908 and 1909, in pounds.

(Copper extracted from ore or contained in the ore produced.)

Country.	1908.	1909.
Germany	45,194,300	50,264,880
England	1,543,220	1,543,220
Italy	6,613,800	6,172,880
Norway	20 502,780	20,723,240
Austria	3,527,360	3,747,820
Russia	44,973,840	39,682,800
Sweden	4,409,200	4,409,200
Spain and Portugal	117,725,640	116,843,800
Turkey	2,425,060	1,763,680
Hungary	5,070,580	10,141,160
Total Europe	251,985,780	255,292,680
Canada	63,933,400	54,012,700
Mexico	89,506,760	126,103,120
Newfoundland	3,306,900	3,086,440
United States	942,570,000	1,092,951,624
Total North America	1,099,317,060	1,276,153,884
Argentina	440,920	1,322,760
Bolivia	5,511,500	4,629,660
Chile	85,758,940	80,247,440
Peru	33,509,920	35,934,980
Cuba	6,613,800	5,952,420
Total Central and South America	131,835,080	128,087,260
Cape Colony	9,920,700	10,361,620
Namaqualand	5,291,040	5,291,040
Other Africa	....	17,857,260
Total Africa	15,211,740	33,509,920
Japan	96,341,020	105,379,880
Australia	88,404,460	77,161,000
Grand total	1,683,095,140	1,875,584,624

LEAD.

By C. E. SIEBENTHAL.

INTRODUCTION.

An estimate of the production of refined lead in 1909 was given out in the form of a press bulletin on January 1, 1910. This was based on reports from every smelter giving the actual production for the first ten or eleven months, with estimates for the remainder of the year. The total thus obtained varied considerably less than 1 per cent from the final figures of production. The complete figures of production and consumption of primary[a] refined lead, of imports and exports of lead in ore and bullion, and of the recovery of secondary lead were given in the advance statement of lead production which was published December 24, 1910. The present report contains, in addition, tables showing the production, consumption, imports and exports for a period of years, and a comparison of the mine and the smelter production of lead by States.

The statistics of production in this country have been compiled by the United States Geological Survey from confidential reports by each lead-smelting company in operation during the year 1909. These reports were procured by the Bureau of the Census and the United States Geological Survey acting in cooperation. As the metal statistics collected by the Bureau of the Census were obtained in connection with the general census of the industries of the United States, by direct visitation of field agents, the time required for the work was much greater than has been necessary in previous years. This accounts for the late appearance of this report. The statistics of the recovery of secondary lead were collected by the United States Geological Survey. The statistics of domestic consumption are taken in part from the smelter returns and in part from the records of the Bureau of Statistics of the Department of Commerce and Labor, and the tables for foreign production and consumption were compiled from the sources indicated.

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[a] By primary lead is meant lead which has been produced directly from ore. This term is used for purposes of distinction from secondary lead, which is obtained by refining skimmings, drosses, old metals, etc., figures for the production of which are given on a later page. Wherever in this report the word "lead" is used without qualification primary lead is to be understood.

STATE OF LEAD INDUSTRY IN GENERAL.

The lead industry of the world had as a whole a fairly prosperous year, several European countries and the United States making good gains, though conditions in the latter country did not fulfill the expectation at the beginning of the year. The lead output of Australia suffered severely from the labor trouble which prevailed for the first half of the year.

In the United States, despite great gain in soft-lead production due primarily to the southeast Missouri desseminated lead district, the production from domestic ores failed to reach the mark set in 1907; but this loss was more than made up by increase in the production from foreign ores, so that the total production was the greatest recorded. Missouri and Utah both made good gains over their 1908 figures, and each had the greatest production in its history.

PRODUCTION.

The production of lead in the United States since 1825 from domestic ores and from foreign ores and base bullion is shown in the table following. For the early years, in the absence of official records, the figures have been compiled from the best available sources. The figures for the period from 1825 to 1853 are those published by Whitney; those for the later years were collected by E. A. Caswell. Totals for 1882 were compiled from statistics gathered by the Census Bureau. Since 1882 the figures have been annually collected by the United States Geological Survey.

According to Hahn,[a] argentiferous lead ore was smelted in Montana and Nevada as early as 1866–67, but for the silver only, as the value of the lead would not pay transportation charges to market. With the completion of the Union Pacific Railroad in 1869 and the development of the mines at Eureka, Nev., the production of lead bullion began. The first figures of this production which are available are for 1873. It is evident from the totals for 1871 and 1872 that not much bullion was produced before 1873. Estimates have been made for these years, as well as for 1874, in order to arrive at totals for the different classes of lead. Foreign bullion, principally from Mexico, began in 1891 to be imported into this country for refining, but before 1906 the annual quantities so imported were not distinguished from the lead imported in ore. Since the soft lead is all domestic, the desilverized lead of domestic origin can be readily found by subtracting the total lead of foreign origin from the total desilverized lead production of that year, or by subtracting the soft lead from the total domestic lead of that year. Previous to 1906 the total production of antimonial lead is included in the production of refined, desilverized lead, but since that date it has been excluded.

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[a] Mineral Resources U. S. for 1882, U. S. Geol. Survey, 1883, p. 324.

Production of refined lead in the United States, 1825–1909, in short tons.

Year.	Antimonial lead.[a]	Desilverized lead.[b]	Soft lead.	Total production.[b]	From domestic ores and base bullion.	From foreign ores.[c]	From foreign base bullion.[d]
1825–1868			676,200	676,200	676,200		
1869			17,500	17,500	17,500		
1870			17,830	17,830	17,830		
1871		[e] 1,000	[e] 19,000	20,000	20,000		
1872		[e] 5,330	[e] 20,500	25,880	25,880		
1873		20,159	22,381	42,540	42,540		
1874		[e] 28,524	[e] 23,556	52,080	52,080		
1875		34,909	24,731	59,640	59,640		
1876		37,649	26,421	64,070	64,070		
1877		50,748	31,152	81,900	81,900		
1878		64,290	26,770	91,060	91,060		
1879		64,650	28,130	92,780	92,780		
1880		70,135	27,690	97,825	97,825		
1881		86,315	30,770	117,085	117,085		
1882		103,875	29,015	132,890	132,890		
1883		122,157	21,800	143,957	143,957		
1884		119,965	19,932	139,897	139,897		
1885		107,437	21,975	129,412	129,412		
1886		114,829	20,800	135,629	130,629	[f] 5,000	
1887		135,552	25,148	160,700	145,700	[f] 15,000	
1888		151,465	29,090	180,555	151,919	28,636	
1889		153,709	29,258	182,967	156,397	26,570	
1890		130,403	31,351	161,754	143,630	18,124	
1891	[a] 4,043	171,009	31,397	202,406	178,554	23,852	
1892	[a] 5,039	181,584	31,678	213,262	173,305	39,957	
1893	[a] 5,013	196,820	32,513	229,333	163,982	65,351	
1894		181,404	37,686	219,090	159,351	59,739	
1895		201,992	39,890	241,882	165,709	76,173	
1896	[a] 7,507	221,457	43,537	264,994	187,256	77,738	
1897	[a] 8,867	247,483	43,553	291,036	207,365	83,671	
1898	[a] 8,473	267,842	42,779	310,621	210,676	99,945	
1899	[a] 6,345	263,826	40,566	304,392	208,466	95,926	
1900	[a] 9,906	329,658	48,021	377,679	270,824	106,855	
1901	[a] 10,656	323,790	57,898	381,688	269,266	112,422	
1902	[a] 9,169	303,011	74,050	377,061	276,455	100,606	
1903	[a] 9,579	295,074	83,444	378,518	290,194	88,324	
1904	[a] 11,001	315,284	89,169	404,453	308,603	95,850	
1905	[a] 10,995	296,186	103,116	399,302	318,509	80,793	
1906	10,546	313,886	90,860	404,746	336,200	28,803	39,743
1907	9,910	314,241	99,948	414,189	337,340	43,925	32,924
1908	13,629	295,420	101,013	396,433	298,672	40,272	57,489
1909	12,896	329,311	118,801	448,112	345,255	74,035	28,822
Total		6,652,379	1,754,719	9,083,348	7,436,803	1,646,545	

[a] Included also under desilverized lead and total production prior to 1906.
[b] Including also antimonial lead, except for 1906–1909, inclusive.
[c] Including also lead from foreign base bullion for 1891–1905, inclusive.
[d] Included in lead from foreign ore previous to 1906.
[e] Estimated.

PRODUCTION BY STATES.

The lead content of ores mined and smelted in this country from 1901 to 1905, inclusive, is given below by States from which the ores were derived. The figures were compiled from smelter reports, and it should be noted that they represent the content of the ores and not the actual recovery, which is the quantity available for consumption. The latter quantity, termed merchant lead, has regularly been derived from the figures for lead content by allowing 5 per cent loss therefrom for smelting, desilverizing, and refining.

Lead content of ores smelted by the works in the United States, 1901–1905, by States, in short tons.

State or Territory.	1901.	1902.	1903.	1904.	1905.
Colorado	73,265	51,833	45,554	51,884	56,638
Idaho	79,654	84,742	99,590	108,854	99,027
Utah	49,870	53,914	51,129	56,470	44,996
Montana	5,791	4,438	3,303	3,635	2,207
New Mexico	1,124	741	613	1,363	1,232
Nevada	1,873	1,269	2,237	1,873	2,206
Arizona	4,045	599	1,493	1,499	2,091
California	381	175	55	163	116
Washington	1,029	1,457	538	622	56
Oregon, Alaska, South Dakota, Texas		2,184	1,765	41	101
Missouri, Kansas, Wisconsin, Illinois, Iowa, Virginia, and Kentucky	67,172	79,445	86,597	92,275	104,058
Total lead content American ores smelted	284,204	280,797	292,874	318,679	312,728
Content Mexican ores	11,841	8,755	56,890	24,952	....
Content Canadian ores	9,615	2,164	253	11	....
Content miscellaneous or unknown	804	3,975	2,831	1,113	....

The closer distribution of the lead production among the States from which the ore was derived has necessitated the separate table which follows. The product of refined lead can with difficulty be apportioned according to sources of ore, owing to the fact that lead refiners treat smelted products whose origin may, as in custom refining, be unknown to them, the identity of the ore and thus its original source being preserved only as far as the smelter. Accordingly, this table, showing sources of lead smelted or refined in the United States, is based as far as possible on smelter figures. It includes "pig lead" reported by all known smelters running on Mississippi Valley or southern lead ores, and "lead" produced at all other lead smelters in this country. The greater part of the product reported by smelters operated in conjunction with refineries is in terms of refined lead. A like part of the antimonial lead product is thus eliminated from the "lead" produced and appears only in the figures of production of antimonial lead. No lead ore from the United States was treated elsewhere during the period covered by the table.

Sources of primary lead smelted or refined in the United States, 1906–1909, in short tons.

Source of ore.	1906.	1907.	1908.	1909.	
	Quantity.	Quantity.	Quantity.	Quantity.	Percentage of total.
Domestic ore:					
Alaska	8	....	3	60	0.02
Arizona	2,884	2,340	1,464	1,465	.42
Arkansas	....	15	....	14	.00
California	432	854	515	93	.274
Colorado	50,497	48,876	28,728	29,326	8.32
Georgia	....	2	....	....	....
Idaho	117,117	112,569	98,464	97,183	27.57
Illinois	572	498	363	273	.08
Iowa	270	225	110	15	.004
Kansas	1,932	1,798	2,293	2,764	.78
Kentucky	44	75	....	....	....
Missouri	111,075	122,856	122,451	142,650	40.46
Montana	2,485	2,035	2,320	1,376	.39
Nevada	1,669	3,380	3,796	4,698	1.33
New Hampshire	....	....	....	5	.001
New Mexico	640	1,927	586	1,275	.36
Oklahoma	....	404	1,409	2,268	.64
Oregon	....	....	7	6	.001
South Dakota	....	....	13	....	....
Tennessee	11	16	....	....	....
Texas	25	10	42	42	....
Utah	56,260	61,699	42,455	64,534	18.30
Virginia	....	82	13	....	....
Washington	46	281	391	115	.03
Wisconsin	1,753	3,551	4,013	3,238	.92
Undistributed	380	355	36	303	.09
Zinc residues	2,053	1,318	1,290	1,641	....
Total from domestic ore	350,153	365,166	310,762	354,188	100.00
Foreign ore:					
Africa	....	323	....	3,227	....
Canada	7,238	5,793	341	71	....
Central America	112	....	12	25	....
China	18	....	4	....	....
Mexico	21,435	36,749	38,729	69,100	....
South America	....	911	1,186	1,574	....
Other foreign	....	149	....	38	....
Foreign base bullion:					
Canada	....	....	....	1,816	....
Mexico	39,743	32,924	57,489	27,006	....
Total from foreign ore and base bullion	68,546	76,849	97,761	102,857	....
Grand total, derived from all sources	418,699	442,015	408,523	457,045	....

SOFT LEAD.

The quantity of soft lead recovered in 1907–1909, apportioned according to the source of the ore, as compiled from direct returns by smelters to the Survey, is shown in the following table. In these totals the soft lead which was desilverized is included.

Production of soft lead in the United States in 1907–1909, by States, in short tons.

Source of ore.	1907.		1908.		1909.	
	Quantity.	Percentage of total soft lead.	Quantity.	Percentage of total soft lead.	Quantity.	Percentage of total soft lead.
Arkansas	15	0.01	....	....	14	0.01
Illinois	[illegible]	.39	363	0.28	15	.01
Iowa	[illegible]	.17	110	.08	273	.18
Kansas	[illegible]	1.39	2,293	1.75	2,764	1.83
Kentucky	75	.06	....	....	....	....
Missouri	[illegible]	[illegible]	122,451	93.56	142,650	94.33
Oklahoma	[illegible]	.31	1,409	1.08	2,268	1.50
Tennessee	[illegible]	.01	....	....	....	....
Virginia	82	.06	13	.01	....	....
Washington	87	.07	230	.18	....	....
Wisconsin	3,551	2.74	4,013	3.06	3,238	2.14
Total	129,607	100.00	130,882	100.00	151,222	100.00

ANTIMONIAL LEAD.

The production of antimonial lead from ores derived from all sources, as reported by all desilverizers operating in this country, is shown in the following table:

Production of antimonial lead in the United States from 1891 to 1909, in short tons.

1891	4,043	1901	10,656
1892	5,039	1902	9,169
1893	5,013	1903	9,579
1894		1904	11,001
1895		1905	10,995
1896	7,507	1906	10,546
1897	8,867	1907	9,910
1898	8,473	1908	13,629
1899	6,345	1909	12,896
1900	9,906		

The antimonial content of the antimonial lead produced in 1907 was estimated at 1,561 tons. For later years the antimony content of the antimonial lead has been returned by the smelters, being reported at 2,440 tons in 1908 and at 2,360 tons in 1909. This antimony is in part of domestic origin and in part of foreign origin, the distribution as between these sources being difficult or even impossible to determine. Further details as to the production and consumption of antimony in the United States may be gleaned from the chapter on antimony in this volume.

LEAD PIGMENTS.

In addition to the leaded zinc oxide and zinc-lead oxide pigments, which are noted more particularly in connection with the production of zinc pigments, there are two lead pigments which are produced directly from ore, namely, sublimed white lead and sublimed blue lead. Sublimed white lead consists of lead sulphate 75 per cent, lead oxide 20 per cent, and zinc oxide 5 per cent. Sublimed blue lead consists of lead sulphate 50 to 53 per cent, lead oxide 38 to 41 per cent, with small proportions of lead sulphide, lead sulphite, and zinc oxide. Zinc-lead oxide contains from 46 to 50 per cent of lead sulphate, from 52 to 45 per cent of zinc oxide, and a small amount of zinc sulphate. Leaded zinc oxide may vary from 4 to 20 per cent in lead sulphate, the remainder being zinc oxide with a small portion of zinc sulphate.

The total lead contents of the 1909 production from domestic ores of the above-mentioned pigments was 7,292 short tons, as compared with 7,377 tons in 1908 and with 6,574 tons in 1907.

The St. Louis Smelting and Refining Company in 1909 completed as an adjunct to the lead smelter at Collinsville, Ill., a plant for the manufacture of sublimed lead pigments directly from ore. The pigment works were temporarily closed early in 1910 by an injunction secured by the Picher Lead Company on the ground of infringement of patents controlled by the latter company. The case is still in litigation.

SECONDARY LEAD.

Important sources of lead are skimmings, drosses, old metal, and alloys, as babbitt, solder, and type metal. The recovery of lead by refining these materials constitutes an integral portion of the lead industry. This business is mostly carried on at small refineries scattered over the United States, but the large smelters and refineries working primary lead frequently find it advantageous to incorporate material from secondary sources. In such cases it has been noted on the reports of the smelters to the Survey, and to that extent the production of secondary lead has always been taken into account. Since 1907, however, statistics have been collected from the secondary refineries, for the first two years by the writer, and for 1909 by J. P. Dunlop of the United States Geological Survey. In 1907 and 1908, reports were obtained from the larger plants only, but in 1909 the scope of the canvass was greatly enlarged and the number of firms reporting was increased from 44 to 100, with the result that the figures of production for that year show an increase of about 60 per cent. The product of such secondary refineries is of two classes, pig lead and lead in alloys. In the latter case the lead may have been recovered in the form of pig lead and alloyed at the refinery or it may have been refined as an alloy, being brought to the desired composition by addition of the requisite metal.

Production of secondary lead in the United States in 1907–1909, in short tons.

	1907.	1908.	1909.
Pig lead	9,990	7,990	17,822
Lead in alloys	15,508	10,543	23,327
Total recovered lead	25,498	18,533	41,149

COMPARISON OF STATE TOTALS BASED ON SMELTER RETURNS AND ON MINE REPORTS.

The foregoing figures of the production of metallic lead by the respective States are compiled from reports of individual lead smelters and refineries. For several years the production of the more valuable metals in the Western States has been obtained by the Survey from reports of individual mines. In 1906 the same method was followed in the Atlantic States, and in 1907 the plan was extended to take in the whole country. In order to put the smelter production on the same basis as the mine figures, all the lead which was produced as pigments directly from ore is added to the production of metallic lead. The lead recovered from secondary sources is excluded from these totals, since it has already been reckoned once as pig lead. These facts must be borne in mind in comparing this table with the preceding tables. The state totals obtained by each method are compared in the table following.

Comparison of State totals compiled from smelter and mine returns, 1906–1909, in short tons.

State.	1906.[a]				1907.			
	Totals based on smelter reports.	Totals based on mine reports.	Differences.		Totals based on smelter reports.	Totals based on mine reports.	Differences.	
			Smelter excess.	Mine excess.			Smelter excess.	Mine excess.
Arizona	2,884	2,819	65		2,350	2,330	20	
Arkansas					15	12	3	
California	432	169	263		854	1,313		459
Colorado	50,497	52,051		1,554	50,596	42,703	7,893	
Idaho	117,117	127,502		10,385	112,569	116,912		4,343
Illinois					509	830		321
Iowa					225	242		17
Kansas					1,929	2,555		626
Kentucky					75	34	41	
Missouri					127,373	138,675		11,302
Montana	2,485	2,232	253		2,035	1,874	161	
Nevada	1,669	1,912		243	3,380	3,136	244	
New Mexico	640	1,494		854	2,126	1,905	221	
Oklahoma					476	532		56
South Dakota	0	11		11				
Tennessee					16	0	16	
Texas					10	12		2
Utah	56,260	62,671		6,411	62,073	57,969	4,104	
Virginia					[b] 84	[b] 70	14	
Washington	46	463		417	346	410		64
Wisconsin					3,551	3,499	52	
Undistributed	380				355			
Zinc residues	2,053				1,318			
	234,463	251,324			372,265	375,013		

Comparison of State totals compiled from smelter and mine returns, 1906–1909, in short tons—Continued.

State.	1908.				1909.			
	Totals based on smelter reports.	Totals based on mine reports.	Differences.		Totals based on smelter reports.	Totals based on mine reports.	Differences.	
			Smelter excess.	Mine excess.			Smelter excess.	Mine excess.
Alaska	3	....	3	....	60	19	41	....
Arizona	1,464	1,504	....	40	1,465	1,549	....	84
Arkansas	....	15	....	15	14	24	....	10
California	515	619	....	104	937	751	186	....
Colorado	30,852	26,100	4,752	....	30,912	36,084	....	5,172
Idaho	98,464	103,414	....	4,950	97,183	107,993	....	10,810
Illinois	363	399	....	36	273	295	....	22
Iowa	110	51	59	....	15	36	....	21
Kansas	2,825	2,518	307	....	3,085	1,300	1,785	....
Kentucky	....	....	....	....	....	10	....	10
Missouri	127,620	144,459	....	16,839	147,372	159,435	....	12,063
Montana	2,320	2,298	22	....	1,376	1,492	....	116
Nevada	3,796	3,623	173	....	4,698	4,920	....	222
New Hampshire	....	....	....	....	5	....	5	....
New Mexico	586	437	149	....	1,275	2,515	....	1,240
Oklahoma	1,577	1,781	....	204	2,820	3,427	....	607
Oregon	7	1	6	....	6	....	6	....
South Dakota	13	12	1	....	....	59	....	59
Texas	42	33	9	....	42	46	....	4
Utah	42,455	44,389	....	1,934	64,534	74,243	....	9,709
Virginia	13	38	....	25	....	....	....	....
Washington	593	575	18	....	115	144	....	29
Wisconsin	4,107	4,138	....	31	3,349	3,694	....	345
Undistributed	36	....	....	....	303	....	....	....
Zinc residues	1,290	....	....	....	1,641	....	....	....
	319,051	336,404	....	....	361,480	398,036	....	....

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[a] For 1906 only those States for which there are both smelter and mine reports are taken in order that the discrepancies may aid in explaining differences in the same States in later years. No allowance is made for lead from those States recovered in 1906 in the form of pigments.

[b] Includes, also, production of Georgia and New Hampshire.

The smelter totals represent actual recovery and are found by summing up the total production reported by all companies for each State, respectively, and recalculating all pigments back to equivalent metallic lead on the basis of average analysis of product. In compiling the mine totals each producing property is requested to report actual tonnage of lead ores and concentrates shipped, and from this tonnage the lead content is reckoned by assay value. The quantities thus obtained from all the producing properties in each State are combined to make the total for that State. It is clear that by either method the correctness of the totals is dependent upon complete and correct returns from every producing mine and smelter. It is further essential to the correctness of the mine totals that the assay content be correctly estimated.

With equal conditions affecting the mines and the smelters, the stocks in the ore bins of the smelters should run about even from year to year, and the mine and smelter state totals, making allowance in the former for losses in smelting, should show reasonable agreement. As may be seen from the table, however, there are frequent discrepancies. The causes of these discrepancies fall into four categories. The first is lag, by which is meant the time that elapses between the shipment of ore by the mine and the reduction of the ore by the smelter. This is frequently considerable, for ore raised near the end of the year may remain in the stock bins of the smelter until the succeeding year and, unless balanced by an equivalent lag from the preceding year, will thus lead to an apparent "mine excess." If through accident, business depression, or otherwise, the mines close down, the smelters largely consume their ore stocks, which results in an apparent "smelter excess." The second source of difference is found in error in the mine totals, either in ore tonnage or in the arbitrary calculation of metal content from assay. The dry assay in vogue in the Western States gives results uniformly too low. A decision of the United States circuit court (T. D. 21653) recognizes a differential of 1.5 per cent between the dry assay and chemical analysis. A third source is found in failure of the smelter returns to segregate accurately the ore from the different States. Until 1906 the ore coming from the Joplin district was lumped by the smelters as from Missouri or Missouri-Kansas, though some of it was from Oklahoma. This tended to make a smelter excess for Missouri and a mine excess for Kansas and Oklahoma. The same custom was to a certain extent true of the upper Mississippi Valley district. Though apportioned to the proper States since 1906, the division is confessedly a rough estimate in the case of some of the smelters which do not keep the ore from these regions separate on their books. Lastly, there is not taken into account in these totals the loss in smelting, ranging from 2 to 5 per cent in treating easily reducible ores and up to 10 or more per cent in the more refractory ores. Losses running over 20 per cent have been claimed in smelting ores running high in antimony and arsenic. Lag being left out of account, each State would normally show a mine excess equal to this smelting loss. Any discrepancy which appears in the table may reasonably be ascribed to one or more of these items. In the long run, barring error and allowing for smelting losses and exportation of ore, the "mine excess" will be balanced by equivalent "smelter excess."

SMELTER AND MINE STATE TOTALS IN 1909.

With a few exceptions the discrepancy between smelter and mine State totals is in favor of the mines and no more than balances the loss in smelting. The mine excess in both Colorado and Idaho is doubtless due to lag in smelting. The smelter excess in Kansas must be due to error in distribution by the smelters and in part accounts for the mine excess in Missouri. The comparatively larger mine excess in New Mexico seems to be due to lag in smelting, as is probably true in part of the mine excess in Utah.

TRADE CONDITIONS.

WORLD'S PRODUCTION.

The following table of the production of lead in the world has been calculated from the statistics published by the Metallgesellschaft, the Metallurgische Gesellschaft A.-G., and the Berg- und Metallbank, Aktiengesellschaft, of Frankfurt-am-Main, Germany, with the exception of the substitution of the figures collected by the Geological Survey for the production of the United States. It is to be noted that the production of Central and South American countries is not included in the table. As shown on a preceding page, considerable lead has been smelted and refined in the United States in the last four years from ores produced in those countries. Noteworthy gains in production were made by Belgium, France, Mexico, and especially by the United States; the large loss shown by Australia was a result of the great industrial strike at Broken Hill, lasting all through the first half of the year.

The world's production of lead, 1904–1909, in short tons.

Country.	1904.	1905.	1906.	1907.	1908.	1909.
Australia	131,615	117,946	102,514	106,923	131,376	85,098
Austria-Hungary	14,440	14,881	18,078	16,975	16,118	15,322
Belgium	25,904	25,243	24,471	28,417	33,231	45,525
Canada	18,960	28,329	26,235	23,778	23,846	24,251
France	20,723	26,565	28,219	25,353	27,600	38,581
Germany	151,676	168,211	166,117	157,156	181,167	185,076
Great Britain	26,896	25,684	26,455	30,203	33,120	27,557
Greece	16,755	15,102	13,338	15,212	17,664	16,865
Italy	25,904	21,054	23,479	25,243	28,704	25,353
Japan	1,984	2,535	3,858	3,858	3.312	3,307
Mexico	92,483	82,673	59,524	79,366	121,440	130,071
Russia	331	331	331	110	110	110
Spain	195,989	199,186	199,406	204,848	202,253	202,823
Sweden	661	661	882	772	883	331
Turkey in Asia	11,795	11,464	10,582	11,464	13,027	13,338
Other countries	331	220	220	220	552	4,519
United States (domestic)	307,000	302,000	350,153	365,166	310,762	354,188
Total	1,043,447	1,042,085	1,053,862	1,095,064	1,145,165	1,172,315
United States percentage of world's production	29.5	29.0	33.2	33.3	27.1	30.2

IMPORTS AND EXPORTS.

WAREHOUSE TRANSACTIONS.

Lead imported into the United States as metal or in ore may be entered for immediate consumption, in which case the duty is paid and the lead goes direct to the consumer; or it may be entered for warehouse, bond being given for double the amount of the estimated duty. From warehouse the lead may be withdrawn for consumption, by payment of duty, or it may remain in bond for smelting and refining, finally being either withdrawn for consumption or exported from warehouse with cancellation of bond. The lead entered for immediate consumption and that withdrawn from warehouse for consumption make up the table below of imports for consumption which are expressed in the same terms as those in which they were imported. The lead imported for consumption may be actually used in this country, or it may be manufactured into articles which are exported, in which case the manufacturer is entitled to the benefit of a drawback of 99 per cent of the duties paid. In the table below showing foreign lead exported in manufactures with benefit of drawback, the lead is shown in the form in which it was originally imported. On account of diversity of form it is not feasible to show the articles exported with benefit of drawback. The foreign lead given in the table below as exported from warehouse is likewise shown in the form in which it was imported and entered for warehouse.

The two items, foreign lead exported from warehouse and foreign lead exported in manufactures with benefit of drawback, make up the total foreign lead going out of the country. Lead in warehouse and deductions by liquidation being disregarded, the difference between the sum of these two exports of lead and the total imports of lead constitutes the foreign lead consumed in this country. For the sake of simplicity this foreign lead is carried on the bonded customs warehouse records in the form in which the lead was entered, until the bond is canceled. It must be clearly understood, therefore, that in the table of foreign exports of lead, on a later page, the lead there listed was not exported as lead content of ore and base bullion but as refined lead smelted and refined from them. There is no record kept of the lead in the form in which it is actually exported except for a portion of the articles manufactured from foreign lead and exported with benefit of drawback. For articles not made wholly of lead it would be useless to give weights. But each shipment on which drawback is claimed is accompanied by a manifest of the imported lead used in making the articles and the duty paid thereon. From these manifests is derived the statement of the total quantity of foreign lead used in manufactures exported with the benefit of drawback. For this reason the lead is given in the form in which it was imported.

The following table, taken from the reports of the Bureau of Statistics, shows the lead remaining in warehouse at the close of each year, beginning with 1899, and also the district in which remaining. For the reasons given above, the lead is shown in the terms in which imported. For instance, a considerable part of the lead stated as remaining in ore and base bullion doubtless represents refined lead waiting at the bonded refinery for a favorable market for shipment. If this be borne in mind, the table gives a fair idea of the fluctuations of foreign stock at different times and in different localities.

Lead remaining in warehouse, 1899–1909, in pounds.

December 31—	Form in which entered for warehouse.		Remaining at [a]—					
	Lead in ore and base bullion.	Pigs, bars, and old.	Newark, N. J.	Perth Amboy, N. J.	Chicago, Ill.	El Paso, Tex.	San Francisco, Cal.	Puget Sound.
1899	22,302.286	17,033	6,343,323	12,070,835	215,032	2.552.911	122.851	976,012
1900	42,379,270	....	10,692,307	10,157,018	2,236,555	2,642,568	3.149,975	6,147,500
1901	33,225,677	18.808	5,927.039	7,964,931	....	1,325,874	2,521,095	6,122,420
1902	47,817,806	59,487	8,198,289	14,176,702	4,157.558	2,949,481	3,745,809	2,073,152
1903	21,387,901	....	5,192,823	3,850,638	3,896,471	4,079,021	3,430,526	938,422
1904	22,962,984	....	1,629,852	7,482,560	5,999,972	6,062,072	1,732,742	46,295
1905	16,296,391	112	10,117	6,746,035	3,755,890	4,553,951	260,777	941,623
1906	11,382,998	128.812	1,743,853	3,870,951	2,736.979	229,267	306,607	2,480,817
1907	25,794,409	93,286	1,057,836	6,197,503	7,918,991	8,846,533	1,226,261	....
1908	36,923,604	206,651	6,772,049	23,356,695	3,950,517	2,381,867	15,526	....
1909	34,655,780	158,208	4,941,828	18,213,808	9,461,123	1,832,867	39,911	....

[a] Also in 1900 at Kansas City, Mo., 1,776,137 pounds, and at Omaha, Nebr., 5,306,351 pounds; in 1901, at Denver, Colo., 9,364,318 pounds; and in 1902, at Denver, Colo., 12,516,815 pounds.

IMPORTS.

The following tables of lead and type metal imported and entered for consumption and of general imports of lead are taken from the reports and records of the Bureau of Statistics:

Lead imported and entered for consumption in the United States, 1900–1909, in pounds.

Year.	Lead in ore.[a]		Base bullion.[b]		Pigs, bars, and old.		Sheets, pipe, and shot.		Not otherwise specified.	Total value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.		
1900	10,209,742	$623,802	....	....	3,673,616	$76,141	27,945	$1,393	$877	$702,213
1901	10,324,119	272,396	....	....	3,604,157	88,056	56,735	2,773	1,234	364,459
1902	14,499,339	316,005	....	....	12,443,615	319,035	224,209	7,765	5,258	648,063
1903	41,155,130	716,128	....	....	8,972,635	255,135	17,008	810	1,589	973,662
1904	19,015,540	328,279	....	....	17,334,033	480,823	69,581	2,441	5,277	816,820
1905	49,526,990	784,548	....	....	10,379,753	329,209	77,668	3,813	1,139	1,118,709
1906	44,560,258	755,545	587,731	$15,635	24,882,983	960,998	346,177	17,250	4,503	1,753,931
1907	13,363,875	286,802	1,196,224	35,303	15,667,170	718,198	734,418	39,210	3,450	1,082,944
1908	2,806,524	76,746	11,415,463	251,266	5,346,290	176,363	42,377	2,026	9,843	516,244
1909	7,080,753	142,847	21,896,611	454,568	7,095,442	229,751	40,434	2,056	32,284	861,506

[a] For period 1900–1905, inclusive, the gross weight and value of base bullion imported for consumption are also included.

[b] For the years previous to 1906 the imports of base bullion (gross weight) are not distinguished from imports of lead in ore.

Type metal imported and entered for consumption, 1899–1909, in pounds.

Year.	Type metal.		Lead content.[a]	
	Gross weight.	Value.	Pounds.	Percentage.
1899	1,110,188	$56,442	....	....
1900	1,032,866	51,242	....	....
1901	3,222,431	116,875	....	....
1902	6,469,971	194,394	....	....
1903	6,603,863	208,728	....	....
1904	8,143,749	221,127	6,884,423	84.5
1905	13,932,013	456,155	11,476,629	82.4
1906	19,602,471	900,608	15,896,629	81.1
1907	14,832,673	932,027	12,095,027	81.5
1908	4,110,486	156,847	3,265,815	79.5
1909	13,993,889	532,108	11,339,378	81.0

[a] Prior to 1904 the lead content of the type metal was not given. Besides lead, the chief constituent of the type metal is antimony.

Imports of lead, in ore, base bullion, and refined, by countries, 1904–1909, in pounds.

Country.	1904.	1905.	1906.	1907.	1908.	1909.
United Kingdom	494,556	1,589,859	9,852,760	433,971	399,569	191,243
Germany	731,222	250,241	2,006,369	456,649	695,151	2,821,967
Other European countries	165,661	117,699	3,920,313	6,922,276	1,699,509	1,385,616
Total from Europe	1,391,439	1,957,799	15,779,442	7,812,896	2,794,229	4,398,826
British North America	17,903,798	16,362,916	18,514,244	13,272,900	1,291,044	4,133,755
Mexico	205,805,911	175,167,694	133,512,526	137,543,692	219,567,193	215,203,714
South America	579,918	3,154,483	315,265	883,355	469,770	1,942,847
Other countries	22,246	112,516	147,462	117,138	26,418	2,683,950
Total imports	225,703,312	196,755,408	168,268,939	159,629,981	224,148,654	228,363,092

In the foregoing table, 98 per cent of the imports of lead from Europe in 1907 were in the form of refined lead, and 90 per cent of the imports from all other countries consisted of ore and base bullion. In 1908, on the contrary, 75 per cent of the imports from Europe consisted of ore and base bullion, and 98 per cent of the imports from other countries were likewise of ore and base bullion. In 1909 the imports from Europe of lead in ore and base bullion had increased to

96 per cent, the imports from other countries remaining about stationary at 97 per cent in the form of ore and base bullion.

The following table shows the imports of lead in ore, base bullion, and pigs, bars, sheets, and old for the years 1907–1909:

Imports of lead, by classes, 1907–1909, in pounds.

Year.	Lead in ore (lead content).	Base bullion.		Pigs, bars, sheets, and old.	Total lead content.[a]
		Gross weight.	Lead content.[a]		
1907	64,815,254	76,259,828	74,594,313	18,554,899	157,964,466
1908	64,708,204	153,921,829	150,560,176	5,518,621	220,787,001
1909	71,357,868	149,852,559	146,579,779	7,152,665	225,090,312

[a] Lead content of bullion estimated on the basis of average lead content of imports of base bullion in 1910.

EXPORTS.

DOMESTIC EXPORTS.

The average difference between the New York and the London lead prices for the last ten years is not far from 1½ cents per pound. This being the case, domestic lead exports should be expected only under temporary and very unusual circumstances. The practice of the Bureau of Statistics is to class all exports of lead articles manufactured in this country as domestic exports whether the lead be of domestic or foreign origin. The table of exported lead and manufactures of lead of domestic production, made up from the records of the Bureau of Statistics, and heretofore published in this report, must be duplicated in part if not completely in the following table of exports of manufactures with benefit of drawback. For this reason it has been decided to abandon the table of domestic exports, as previously published.

FOREIGN EXPORTS.

By foreign lead exports is meant the exports of lead of foreign origin which has been smelted, refined, or manufactured in this country and then shipped abroad. The following table, made up from the records of the Bureau of Statistics, shows the total lead exported for a period of years, but it must be borne in mind, as pointed out on a previous page, that the actual exports were not in form shown in the table which is the import form, but instead consisted of refined lead and lead manufactures. The quantities of lead exported from warehouse are exact, but the quantities given of lead in manufactures are subject to the waste in manufacturing.

Under the present tariff regulation the lead that must be sent out before the bond can be canceled is that actually recovered in smelting and refining the ore and base bullion. Under the preceding tariff the bond was canceled when 90 per cent of the lead content of the ore or gross weight of the base bullion was shipped out. If then, in refining base bullion, more than 90 per cent of the total weight was recovered as lead, the bond would be canceled on the exportation of that 90 per cent and the excess above 90 per cent could remain in this country without payment of duty. No doubt in past years considerable foreign lead used in this country has escaped duty in this wise.

Exports of foreign lead, 1900–1909, in pounds.

Year.	Exported from warehouse.							Exported in manufactures with benefit of drawback.	
	Lead content ore. [a]		Lead content base bullion. [a]		Pigs, bars, and old.		All other manufactures.	Lead content ore.	Pigs, bars, bullion, and old.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Value.	Quantity.	Quantity.
1900...	197,795,960	$3,840,798	....	....	30,163	$564	$2,519	1,705,970	6,861,030
1901...	194,724.197	4,183,101	....	....	50,000	2,500	4,924	9,452,628	5,935,331
1902...	157,891,135	3,551,380	....	....	43.130	1.000	764	2,173,559	9,501,049
1903...	163,774,605	2,908,531	....	....	55.566	1,627	7,799	2,339,106	9,331,256
1904...	167,686,199	2,844,403	....	....	87,471	3,937	32.467	2,946,810	10,445,974
1905...	117,263,861	2,378,327	....	....	1,647,523	54,993	7,846	3.584,610	12,700,971
1906...	94,449,751	2,303,382	....	....	48,680	1,138	2,825	3,447,478	8.536,424
1907...	102,847,310	2,416,082	....	....	47,078	2,169	3,033	1,826,756	14,709,149
1908...	153,657,371	3,068,427	....	....	56,000	1,500	32,026	9,392,428	9,114,209
1909...	118,325.560	2,002,644	[b] 53,817,393	$1,036,080	11,447	487	697	2,992,967	6,598,149

[a] Prior to June, 1909, exports of foreign lead from warehouse do not distinguish between lead content of ore and gross weight of base bullion.

[b] For six months, July–December, 1909.

CUSTOMS DUTIES.

The Payne-Aldrich tariff of 1909, effective August 6, 1909, made a slight change in the duty on lead pipe, sheets, shot, wire, etc., and a very important change in the section regulating the smelting and refining of lead in bond. Under the tariff of 1897 the customs bond was canceled upon the exportation of 90 per cent of the weight of base bullion or lead contents of ore imported. Under the present tariff the bond is canceled only upon the exportation of the actual quantity of lead produced from the base bullion and ore. The sections of the new tariff which are concerned with lead and lead products are as follows:

181. Lead-bearing ore of all kinds, one and one-half cents per pound on the lead contained therein: *Provided*, That on all importations of lead-bearing ores the duties shall be estimated at the port of entry, and a bond given in double the amount of such estimated duties for the transportation of the ores by common carriers bonded for the transportation of appraised or unappraised merchandise to properly equipped sampling or smelting establishments, whether designated as bonded warehouses or otherwise. On the arrival of the ores at such establishments they shall be sampled according to commercial methods under the supervision of government officers, who shall be stationed at such establishments, and who shall submit the samples thus obtained to a government assayer, designated by the Secretary of the Treasury, who shall make a proper assay of the sample and report the result to the proper customs officers, and the import entries shall be liquidated thereon, except in case of ores that shall be removed to a bonded warehouse to be refined for exportation as provided by law. And the Secretary of the Treasury is authorized to make all necessary regulations to enforce the provisions of this paragraph.

182. Lead dross, lead bullion or base bullion, lead in pigs and bars, lead in any form not specially provided for in this section, old refuse lead run into blocks and bars, and old scrap lead fit only to be remanufactured; all the foregoing, two and one-eighth cents per pound; lead in sheets, pipe, shot, glaziers' lead and lead wire, two and three-eighth cents per pound.

191. Type metal, one and one-half cents per pound on the lead contained therein.

49. Red lead, two and five-eighths cents per pound.

53. White lead, and white pigment containing lead, dry or in pulp, or ground or mixed with oil, two and one-half cents per pound.

58. Lead: Acetate of, white, three cents per pound; brown, gray, or yellow, two cents per pound; nitrate of, two and one-fourth cents per pound; litharge, two and one-half cents per pound.

Sec. 24. That the works of manufacturers engaged in smelting or refining, or both, of ores and crude metals, may upon the giving of satisfactory bonds be designated as bonded smelting warehouses. Ores or crude metals may be removed from the vessel or other vehicle in which imported, or from a bonded warehouse, into a bonded smelting warehouse without the payment of duties thereon and there smelted or refined, or both, together with other ores or crude metals of home or foreign production: *Provided*, That the several charges against such bonds may be canceled upon the exportation or delivery to a bonded manufacturing warehouse, established under section twenty-three of this act, of the actual amount of lead produced from the smelting or refining, or both, of such ores or crude metals: *And provided further*, That said lead may be withdrawn for domestic consumption or transferred to a bonded customs warehouse and withdrawn therefrom upon the payment of the duties chargeable against it in that condition: *Provided further*, That all labor performed and services rendered pursuant to this section shall be under the supervision of an officer of the customs, to be appointed by the Secretary of the Treasury, and at the expense of the manufacturer: *Provided further*, That all regulations for the carrying out of this section shall be prescribed by the Secretary of the Treasury.

CONSUMPTION.

In statements of lead consumption in these reports previous to 1907 it was the custom to take into account the smelter stocks of lead at the beginning and at the close of the year. It is not to be denied that for the individual year this gives closer figures. It is just as true that account of trade stocks should also be taken to arrive at accurate results; but this is manifestly outside the scope of this bureau. It has been found impossible to obtain a statement of stocks from one large producer since 1906; hence consumption has been calculated without reference to domestic stocks. A very considerable part, however, amounting to between one-fourth and one-fifth of the lead smelted and refined in this country, is lead of foreign origin smelted in bond, and it is possible to obtain the stocks of this portion, since they are reported annually by the Bureau of Statistics as "merchandise remaining in warehouse at close of year." A certain element of error is introduced by the fact that the imports, the exports, and the warehouse stocks, as given, include lead in both ore and base bullion. So far as imports are concerned, the relative quantities of lead in ore and of base bullion are shown in the table on a preceding page, entitled "Imports of lead, by classes," based upon the records of the Bureau of Statistics, and corroborated in the preceding table giving the "sources of primary lead smelted or refined in the United States," based upon smelter reports. For exports and warehouse stocks no such division can be made, because the classes used therein represent the condition of the metal when imported, and do not change with the reduction of the metal in bond. Nevertheless, it is deemed advisable to use warehouse stocks as giving a better estimate of consumption. It is necessary, therefore, to include all classes of lead imports as well as all classes of lead exports.

In the following table "lead" includes all kinds—lead in ore, base bullion, pigs, bars, and old. The figures of domestic production are based upon the returns by the smelters; all other figures are from the records of the Bureau of Statistics. Decrease by liquidation covers losses in smelting and refining in bond and other corrections. Because warehouse stocks are used in lieu of smelter stocks the result given below is lead "available for consumption." The "apparent consumption" of previous reports would be this quantity increased or diminished by the increase or decrease of domestic stocks during the year.

Consumption of primary lead in the United States, 1907–1909, in short tons.

	1907.	1908.	1909.
Supply:			
Stock in bonded warehouses January 1	5,756	12,944	18,565
Imports—			
For consumption	15,246	9,805	18,036
For warehouse	64,569	102,241	96,145
Production from domestic ores	365,166	310,762	354,188
Total supply	450,737	435,752	486,934
Withdrawn:			
Exports of foreign lead—			
From warehouse	51,447	76,857	86,077
In manufactures, with benefit of drawback	8,268	9,254	4,796
Decrease by liquidation	4,578	13,425	8,643
Stock in bonded warehouses December 31	12,944	18,565	17,405
Total withdrawn	77,237	118,101	116,921
Available for consumption	373,500	317,651	370,013

For facility of comparison of consumption in the United States with that of the world, the consumption of the former has been calculated with and without stocks for a period of years, as shown in the following table. Consumption of lead, as shown in the second column, means the production of refined lead minus excess of exports over imports or plus excess of imports over exports. Additions made to stock during the year will thus appear as consumed, but as such stocks are apt to go into the market within the next year and cut down the apparent consumption to that extent, they must compensate in the long run, leaving an accurate average measure of the consumption. The statistics of consumption of foreign countries as given in the table are taken from the estimates of the Metallgesellschaft, etc., which are also compiled without regard to stocks. In the following table, the first column gives, for the sake of comparison, the consumption with stocks taken into consideration; the remainder of the table disregards stocks. In neither column showing the United States consumption is the production of secondary lead taken into account.

World's consumption of pig lead, exclusive of secondary lead, 1898–1909, in short tons.

Year.	Stocks considered.	Stocks disregarded.			
	United States.	United States.	Foreign countries.	Total world's consumption.	United States, percentage.
1898	227,452	225,177	651,018	876,195	25.7
1899	226,315	230,294	652,782	883,076	26.1
1900	269,302	279,172	667,002	946,174	29.5
1901	271,934	284,126	663,805	947,931	29.9
1902	332,484	300,643	685,079	985,722	30.5
1903	300,167	284,556	701,945	986,501	28.8
1904	319,543	320,330	719,471	1,039,801	30.8
1905	347,015	343,682	736,998	1,080,680	31.8
1906	376,337	376,981	703,378	1,080,359	34.9
1907	[a] 373,500	386,711	697,205	1,083,916	35.7
1908	[a] 317,651	336,292	807,024	1,143,316	29.4
1909	[a] 370,013	368,853	799,939	1,168,792	31.5

[a] See preceding table, "Consumption of primary lead in the United States" in 1907–1909.

Consumption of lead, stocks and secondary lead disregarded, in 1906–1909, by countries, in short tons.

Country.	1906.	1907.	1908.	1909.
Australia	4,960	5,952	8,501	5,401
Austria-Hungary	26,235	27,778	31,906	34,061
Belgium	25,022	34,723	22,963	49,714
Canada	17,416	15,983	17,664	17,086
France	94,688	89,397	113,712	121,694
Germany	214,838	206,130	233,275	235,010
Great Britain	213,956	214,287	252,595	219,909
Holland	5,512	5,732	5,961	6,504
Italy	33,400	33,290	40,296	35,494
Japan	15,983	15,983	8,832	9,921
Russia	27,558	27,668	49,349	42,218
Switzerland	5,842	5,842	6,514	5,842
Other European countries	3,307	3,417	4,416	4,409
Other countries	14,661	11,023	11,040	12,676
United States	376,981	386,711	336,292	368,853
Total	1,080,359	1,083,916	1,143,316	1,168,792

USE OF LEAD IN THE UNITED STATES.

The United States Geological Survey does not collect statistics of the use of lead. The following table is from figures published in the Engineering and Mining Journal, which purport to cover about 90 per cent of the total consumption:

Use of lead in the United States, 1907–1909.

	1907.		1908.		1909.	
	Quantity.	Percentage.	Quantity.	Percentage.	Quantity.	Percentage.
	Short tons.		*Short tons.*		*Short tons.*	
White lead and oxides	115,000	34.8	117,500	40.5	134,138	38.0
Pipe	41,000	12.4	33,800	11.6	52,914	15.2
Sheets	21,500	6.5	16,400	5.7	23,421	6.7
Shot	28,000	8.5	31,600	10.9	36,433	10.4
Other purposes	125,238	37.8	90,700	31.3	104,094	29.7
Total	330,738	100.0	290,000	100.0	351,000	100.0

PRICES AND VALUE.

PRICES.

The year opened with lead at 4.2 cents per pound, and through January showed a slight recovery from the gradual decline that had marked the closing months of 1908. However, the effect of tariff agitation on general business and the threatened reduction of the tariff on lead brought about a decline, which in March reached the lowest figure of the year at 3.95 cents per pound. At this point a reaction set in on the strength of a pretty general conviction that the lead schedule would not be altered, and prices rose gradually to the end of the year, closing at 4.7 cents. The average New York price for the year was 4.3 cents per pound, an increase of 0.1 cent over the average for 1908. These are the figures used by the United States Geological Survey in estimating the value of the domestic production of primary lead for those years.

The London market was upheld during the early part of the year by the encouraging prospect of the lead convention as well as by the strike in the Broken Hill district of Australia, the highest price of the year being reached in March, at £13 15s. per long ton (3 cents per pound). The decline which followed reached its culmination in August, with lead at £12 6s. 3d. (2.7 cents per pound). The price held about level through the closing months, the average for the year being £13 1s. 11d. (2.8 cents per pound).

In the following table are shown the highest and the lowest prices of lead at New York in each month during the last eight years. All figures for prices are in cents per pound. Those for 1906 and later are based upon daily quotations published in the Engineering and Mining Journal and those for preceding years on quotations published in the Iron Age.

Highest and lowest prices of lead at New York City, monthly, 1901–1909, in cents per pound.

Year.	January.		February.		March.		April.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
1901	4. 37½	4. 37½	4. 37½	4. 37½	4. 37½	4. 37½	4. 37½	4. 37½
1902	4. 10	4. 00	4. 10	4. 05	4. 10	4. 05	4. 10	4. 05
1903	4. 10	4. 05	4. 10	4. 05	4. 65	4. 10	4. 65	4. 35
1904	4. 50	4. 25	4. 50	4. 40	4. 60	4. 50	4. 60	4. 50
1905	4. 60	4. 45	4. 50	4. 45	4. 50	4. 45	4. 55	4. 50
1906	5. 60	5. 60	5. 60	5. 35	5. 35	5. 35	5. 50	5. 35
1907	6. 00	6. 00	6. 00	6. 00	6. 00	6. 00	6. 00	6. 00
1908	3. 80	3. 55	3. 75	3. 70	4. 00	3. 65	4. 10	3. 90
1909	4. 22½	4. 12½	4. 15	3. 92½	4. 10	3. 92½	4. 25	4. 10

Year.	May.		June.		July.		August.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
1901	4. 37½	4. 37½	4. 37½	4. 37½	4. 37½	4. 37½	4. 37½	4. 37½
1902	4. 10	4. 05	4. 10	4. 05	4. 10	4. 05	4. 10	4. 05
1903	4. 35	4. 30	4. 35	4. 10	4. 10	4. 05	4. 10	4. 05
1904	4. 50	4. 25	4. 35	4. 20	4. 30	4. 10	4. 20	4. 10
1905	4. 55	4. 50	4. 55	4. 50	4. 60	4. 50	4. 85	4. 60
1906	5. 75	5. 50	5. 75	5. 75	5. 75	5. 75	5. 75	5. 75
1907	6. 00	6. 00	6. 00	5. 75	5. 75	5. 25	5. 25	5. 25
1908	4. 37½	4. 05	4. 52½	4. 32½	4. 52½	4. 40	4. 62½	4. 47½
1909	4. 35	4. 20	4. 35	4. 35	4. 35	4. 30	4. 42½	4. 27½

Year.	September.		October.		November.		December.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
1901	4. 37½	4. 37½	4. 37½	4. 37½	4. 37½	4. 37½	4. 37½	4. 00
1902	4. 10	4. 05	4. 10	4. 05	4. 10	4. 05	4. 10	4. 05
1903	4. 40	4. 10	4. 40	4. 35	4. 40	4. 10	4. 25	4. 10
1904	4. 25	4. 20	4. 30	4. 20	4. 50	4. 20	4. 65	4. 60
1905	4. 90	4. 85	5. 30	4. 85	5. 40	5. 15	5. 90	5. 25
1906	5. 75	5. 75	5. 75	5. 75	5. 75	5. 75	6. 00	5. 75
1907	5. 25	4. 75	4. 75	4. 75	4. 75	4. 00	4. 10	3. 35
1908	4. 60	4. 52½	4. 47½	4. 20	4. 40	4. 25	4. 30	4. 12½
1909	4. 40	4. 32½	4. 37½	4. 32½	4. 40	4. 32½	4. 70	4. 37½

VALUE.

The value in 1909 of the output of domestic lead, 354,188 short tons, based upon the average New York price, was $30,460,168, as compared with 310,762 short tons, valued at $26,104,008, in 1908, and with 365,166 short tons, valued at $38,707,596, in 1907.

THE LEAD CONVENTION.

After long-continued efforts, many of the principal foreign lead interests succeeded at Paris, early in the year, in forming an organization, the International Sales Association, composed of Spanish, Belgian, and German producers and metal-selling companies, together with Australian and American producers who consign lead to the European market. The principal German producer, the Braubach silver-lead works, though not a member of the association, is acting in concert. The combination became effective May 1, 1909, and is said to control about half the European supply. The object of the association is to avoid price cutting, and to introduce economies in the distribution of lead by the establishment of a single selling agency and the allotment of spheres of sales. The Metallgesellschaft was chosen as the sales agency, and Frankfurt-am-Main became the principal lead market of the world, superseding London in this respect.

The association has not had everything its own way, however, but has had to meet the active competition of the independent producers and of the other large metal houses, in particular of Beer, Sondheimer & Co., who, through their Australian contracts and their control of the output of certain Spanish works and of the Rhine-Nassau and Overpelt works, were able to offer effective opposition. The year closed with lead at a somewhat reduced figure, so that as far as may be judged by results the convention did not dominate the market and exerted no marked influence upon it.

THE CANADIAN LEAD BOUNTY.

Commencing June 30, 1908, the lead bounty, somewhat increased, was renewed by the Dominion government for another five-year period. The bounty amounts to 75 cents per 100 pounds lead content of Canadian ore delivered to Canadian smelters when the London price of lead does not exceed £14 10s per long ton (3.15 cents per pound). With increase in the price of lead, the bounty decreases at the same ratio, ceasing altogether when lead is about £18 per long ton (3.91 cents per pound).

The result of the bounty is to maintain to the producers a steady value for lead, under the present arrangement, £18 per long ton. The new rate has apparently effected a considerable stimulation of lead production, as, according to report, the bounty paid out during the first year of its operation, ending June 30, 1909, amounted to about $340,542 as compared with $307,432 for the preceding year and with $712,000 during the whole preceding five-year period. This production is chiefly from the mines of British Columbia, and prior to the operation of the bounty was largely smelted and refined in the United States.

SUMMARY.

The following tabular statement gives the general items regarding domestic and world production and consumption. The figures for domestic items are those compiled by this office, and the figures for the world items are based upon statistics compiled by the Metallgesellschaft, etc.

Summary of lead statistics, 1907–1909, in short tons.

	1907.	1908.	1909.
Production of refined lead in the United States	414,189	396,433	448,112
Production of desilverized lead in the United States	314,241	265,564	296,891
Production of soft lead in the United States (including desilverized soft)	129,607	130,882	151,222
Production of antimonial lead in the United States	9,910	13,629	12,896
Total production of lead from domestic ores	365,166	310,762	354,188
Production of secondary lead in the United States	25,498	18,533	41,149
Consumption of lead in the United States (disregarding stocks)	386,711	336,292	368,853
World production (approximate)	1,095.064	1,145,165	1,172,315
World consumption (approximate)	1,083,916	1,143,316	1,168,792
United States (domestic) percentage of world production	33.3	27.1	30.2
United States percentage of world consumption	35.7	29.4	31.5
World rank of United States in production of lead	First.	First.	First.
World rank of United States in consumption of lead	First.	First.	First.

ZINC.

By C. E. Siebenthal.

INTRODUCTION.

An estimate of the production of primary [a] spelter in 1909 was given out in the form of a press bulletin on January 1, 1910. This was based on reports from every smelter and gave the actual production for the first ten or eleven months with an estimate for the remainder of the year. The total thus obtained was nearly 5 per cent in excess of the final figures of production. This discrepancy arose partly through error in one of the estimates and partly through the inclusion in the estimates of spelter made from secondary materials at the regular smelters. These sources of error will be avoided in succeeding reports.

The complete figures of production and consumption of primary spelter and of recovery of secondary zinc were given in the advance statement of spelter production which was published December 24, 1910. The present report contains in addition tables showing the imports and exports, and a comparison of the mine and smelter production of zinc by States.

The statistics of production in this country have been compiled by the United States Geological Survey from confidential reports by each zinc smelting company in operation during 1909. These reports were procured by the Bureau of the Census and the United States Geological Survey, acting in cooperation. As the metal statistics collected by the Bureau of the Census were obtained in connection with the general census of the industries of the United States by direct visitation of field agents, the time required for the work was much greater than has been found necessary by the Survey in previous years; this accounts for the late appearance of the report. The statistics of the recovery of secondary zinc were collected by the United States Geological Survey. The statistics of domestic consumption are taken in part from the smelter returns and in part from the records of the Bureau of Statistics of the Department of Commerce and Labor, and the tables for foreign production and consumption were compiled from the sources indicated.

STATE OF ZINC INDUSTRY IN 1909.

The year 1909 was unique in the history of the zinc-smelting industry in the United States. The large stocks at the smelters at the beginning of the year were reduced nearly one-half; the imports were largely increased; the production exceeded all records, and the apparent consumption was in consequence very heavily increased, being possibly 40,000 tons in excess of the normal—a fact probably to be interpreted as due to the accumulation caused by prospective tariff legislation of excessive stocks in the hands of consumers and dealers. The production of spelter is estimated as equal to the output of 59,344 retorts operating continuously through the year, or about 63 per cent of the total smelting capacity in 1909. The United States regained first place in the world's production of spelter with 30 per cent of the total output.

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[a] In Mineral Resources for 1906, p. 461, zinc derived from ore was called "primary" spelter to distinguish it from the secondary spelter recovered from such sources as drosses, skimmings, and old metal. The former has also been called "virgin" spelter, and the latter has been called "remelted," "reclaimed," and "dross" spelter. The distinctive origin is more plainly suggested by the terms "primary" spelter and "secondary" spelter, and they will be used hereinafter. Where the word "spelter" is used without qualification primary spelter will be understood.

Abroad the main features of the year were the formation of the zinc convention, which increased and steadied prices throughout the year, and the dissolution of the Galvanized Sheet Iron Association, followed by a break in the price of galvanized sheet iron resulting in heavy sales for the rest of the year. The high level of prices in the United States stimulated exports to that country, and the European receipts of zinc concentrates from Australia were largely increased though perhaps not up to expectation.

PRODUCTION.

The production of spelter in the United States began in 1858 in an experimental way[a] and regular production began in 1860 at the Lehigh Zinc Works in the East and at the Matthiesson & Hegeler works in the West. Between 1864 and 1870 nine or ten other zinc smelters were established. Statistics of production are recorded for the years 1873 and 1875, and for the census year ending May 31, 1880. Annual statistics have been collected by the United States Geological Survey since 1882. The annual progress of the zinc-smelting industry since 1873 is shown in the following table:

Annual production of spelter in the United States from domestic and foreign ores, 1873–1909, in short tons.

Year.	From foreign ore.	From domestic ore.	Total.	Year.	From foreign ore.	From domestic ore.	Total.
1873		7,343	7,343	1895		89,686	89,686
1875		15,833	15,833	1896		81,499	81,499
1880		23,239	23,239	1897		99,980	99,980
1882		33,765	33,765	1898		115,399	115,399
1883		36,872	36,872	1899		129,051	129,051
1884		38,544	38,544	1900		123,886	123,886
1885		40,688	40,688	1901		140,822	140,822
1886		42,641	42,641	1902		156,927	156,927
1887		50,340	50,340	1903		159,219	159,219
1888		55,903	55,903	1904		[a] 186,702	186,702
1889		58,860	58,860	1905		[a] 203,849	203,849
1890		63,683	63,683	1906	25,076	199,694	224,770
1891		80,873	80,873	1907	26,115	223,745	249,860
1892		87,260	87,260	1908	19,675	190,749	210,424
1893		78,832	78,832	1909	25,535	230,225	255,760
1894		75,328	75,328				

[a] Including an unknown quantity smelted from foreign ore, small in 1904 but larger in 1905.

PRODUCTION BY STATES.

Two tabulations of the spelter production of the country for a period of years are given, one showing the locality from which the ores were derived, the other the locality in which they were smelted. Each method has its special interests and advantages, depending on whether the view point be that of producer or consumer, or that of resources.

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[a] Ingalls, W. R., Lead and zinc in the United States, p. 314.

The state totals given below are compiled entirely from confidential reports by each zinc-smelting company in operation in the United States in the year in question. Only primary spelter is here included, the recovery of secondary spelter being given in a later table.

The following table shows the sources of all ores and concentrates smelted for spelter in the United States in 1906–1909 and the quantity of zinc actually derived from the ores from these respective sources:

Production of primary spelter in the United States in 1906–1909, apportioned according to source of ore, in short tons.

Source.	1906.	1907.	1908.	1909.	
	Quantity.	Quantity.	Quantity.	Quantity.	Percentage of total.
Arizona	64	77	152	2,862	1.24
Arkansas	1,801	1,911	2,002	135	.06
California	....	140	27	....	....
Colorado	32,456	26,077	24,885	20,121	8.74
Idaho	573	3,508	581	901	.39
Illinois	282	1,446	298	675	.29
Iowa	201	220	516	....	....
Kansas	3,902	13,850	8,628	9,185	3.98
Kentucky	335	358	341	22	.01
Maine	....	1	....	....	....
Missouri	130,348	141,824	123,655	140,676	61.10
Montana	1,415	....	900	4,725	2.05
Nevada	1,768	1,692	398	825	.36
New Jersey	11,206	13,573	6,926	16,035	6.97
New Mexico	555	136	134	3,961	1.72
Oklahoma	....	719	2,235	3,008	1.31
Tennessee	124	181	341	695	.30
Texas	8	16	....	....	....
Utah	2,449	1,972	282	5,960	2.59
Virginia	1,143	771	910	58	.03
Washington	7	....	....	....	....
Wisconsin	11,057	15,273	17,538	20,381	8.85
Total from domestic ores	199,694	223,745	190,749	230,225	100.00
Foreign:					
British Columbia	201	545	2,425	978	....
Mexico	24,875	25,570	17,250	24,557	....
Total from foreign ores	25,076	26,115	19,675	25,535	....
Grand total	224,770	249,860	210,424	255,760	....

The subjoined table is designed to show the localities in which spelter was made.

Production of spelter in the United States, 1903–1909, apportioned according to locality in which smelted, in short tons.

	1903.	1904.	1905.	1906.	1907.	1908.	1909.
Illinois	[a] 47,659	47,740	46,606	47,939	56,056	50,244	67,653
Kansas	88,388	107,048	114,287	129,564	134,108	99,298	103,299
Missouri	9,994	12,150	11,844	11,077	11,732	10,201	7,037
Oklahoma	....	....	....	....	5,035	14,864	28,782
Other States [b]	13,178	19,764	31,112	36,190	42,929	35,817	48,989
Total	159,219	186,702	203,849	224,770	249,860	210,424	255,760
Secondary spelter included	3,302	3,300	1,469	....	....	....	....
Total primary spelter	155,917	183,402	202,380	224,770	249,860	210,424	255,760

[a] Includes Indiana.

[b] Includes New Jersey, Pennsylvania, Virginia, West Virginia, and Colorado.

ZINC PIGMENTS.

There are four white pigments which have zinc for a base, either in whole or in part; namely, zinc oxide, leaded zinc oxide, zinc-lead oxide, and lithopone. All of these may be and in the United States the first three usually are made directly from ore.

Zinc oxide is the most important of these pigments. In European practice the oxide is made from spelter, though in France zinc oxide is made from ore in the electrothermic furnace invented by Côte and Pierron. In the United States the oxide is generally made from ore, but in 1909 of the total production 3,255 tons was made from spelter. The production of zinc oxide made a large gain in 1909, being 68,974 short tons, as compared with 57,237 tons in 1908, an increase of over 20 per cent, but not quite equaling the production of 1906 and 1907. The imports of zinc oxide in 1909 were 3,327 short tons, and the exports for the same period were 14,846 tons.

Leaded zinc oxide and zinc-lead oxide are produced from ore, both in some cases at the same plant, the zinc-lead containing somewhat the larger percentage of lead. The combined production of these two pigments in 1909 was 7,655 short tons, as compared with 8,430 tons in 1908.

Lithopone is an intimate mixture by chemical precipitation of zinc sulphide and barium sulphate. It may be manufactured from spelter or zinc oxide, but in the United States it is now generally made from zinc skimmings, ashes, and scrap.

The zinc content of the various zinc pigments made in the United States in 1909 from ore, both domestic and foreign, was 54,139 short tons, as compared with 48,004 tons zinc content in 1908 and 56,931 tons in 1907.

SECONDARY ZINC.

In the ordinary method of galvanizing, where the material to be coated is dipped into a bath of molten zinc, there is great loss of zinc in the form of semioxidized skimmings and of hard zinc drosses, caused by the alloy formed by the zinc with the iron of the tank and of the article to be galvanized. In the larger galvanizing plants there are furnaces to refine these skimmings and drosses and to recover the spelter. There are also many small plants and some large ones which make a practice of buying galvanizers' skimmings and drosses and of recovering the spelter. A considerable quantity of old metal in the form of various alloys of zinc with copper and other metals is also worked over and brought up to the desired composition by the addition of new metal. At almost every brass foundry and machine shop in the country it is the custom to remelt and use brass filings, grindings, and scrap copper and brass, and it is manifestly impracticable to attempt to take full account of such material. Once in a while the zinc smelters running on ore find occasion to work in a quantity of secondary material. In such cases they have made the proper returns to the Geological Survey, and account has heretofore been taken of such production in these reports as dross spelter. Since 1907, however, statistics have been collected from the secondary smelters and refineries, for the first two years by the writer and for 1909 by J. P. Dunlop. In 1907 and 1908 reports were obtained from the larger plants only, but in 1909 the scope of the canvass was greatly enlarged and the number of firms reporting was increased from about 40 to double that number, with a large increase in reported production. The following table gives the production of secondary zinc in the United States, and a later table gives the production of secondary spelter in Europe:

Production of secondary zinc in 1907–1909, in short tons.

	1907.	1908.	1909.
Secondary spelter	18,841	16,970	33,040
Recovered zinc in alloys	1,417	665	1,181
Total secondary zinc	20,258	17,635	34,221

Inasmuch as this secondary spelter takes the place of so much primary spelter, it is to be added to the figures of consumption of zinc in arriving at the actual consumption.

The exports of zinc dross continue to decrease. They were 7,069 short tons in 1909, as compared with 8,405 tons in 1908, 9,593 tons in 1907, and 15,887 tons in 1906, thus supplementing the figures of increased recovery of secondary zinc. It is to be expected that exports of zinc dross will cease altogether in time, as the zinc contents are naturally worth more in this country than abroad because of the import duty on zinc. Besides the increased recovery of secondary zinc as spelter and in alloys, there was increased use of zinc skimmings and drosses in the manufacture of zinc pigments and lithopone and of zinc chloride. The zinc content of pigments and lithopone made from secondary zinc in 1909 is estimated at a little more than 2,000 tons. The zinc content of zinc chloride manufactured from secondary zinc and used in the treatment of railroad ties, bridge timbers, etc., in 1909 is estimated at 3,839 tons, based on the consumption of zinc chloride for wood preservation as reported by the Forest Service of the United States Department of Agriculture.

COMPARISON OF STATE TOTALS, BASED ON SMELTER AND ON MINE REPORTS.

The foregoing figures of the production of spelter by the respective States are compiled from reports from individual zinc smelters. For several years the production of the more valuable metals in the western States has been also obtained by the Geological Survey from reports of individual mines, and since 1907 this has been extended over the whole country. In order to put the smelter production on the same basis as the mine figures, all the zinc which is manufactured into pigment directly from ore (excluding the quantity in zinc oxide manufactured from spelter, the inclusion of which would entail its duplication in the totals) is added to the production of metallic zinc. The zinc recovered from secondary sources is excluded, since it has already been once reckoned as spelter. These facts must be borne in mind in comparing this table with the table showing the production of spelter. The state totals obtained by each method are compared in the following table:

Comparison of state totals of the production of zinc, 1906–1909, based on smelter and mine reports, in short tons.

State.	1906.[a]				1907.			
	Totals based on smelter reports.	Totals estimated from mine reports.	Differences.		Totals based on smelter reports.	Totals estimated from mine reports.	Differences.	
			Smelter excess.	Mine excess.			Smelter excess.	Mine excess.
Arizona	64		64		89	114		25
Arkansas					1,911	474	1,437	
California		103		103	140	116	24	
Colorado	32,456	43,483		11,027	33,644	26,394	7,250	
Idaho	573	1,033		460	3,508	3,493	15	
Illinois					1,468	737	731	
Iowa					220	145	75	
Kansas					13,850	17,772		3,922
Kentucky					385	0	385	
Maine					1	0	1	
Missouri					142,024	116,752	25,272	
Montana	1,415	3,290		1,875	0	122		122
Nevada	1,768	1,443	325		1,692	1,084	608	
New Jersey					59,588	69,369		9,781
New Mexico	555	8,646		8,091	1,038	375	663	
Oklahoma					719	1,657		938
Tennessee					181	109	72	
Texas					16	22		6
Utah	2,449	3,237		789	2,447	2,726		279
Virginia					771	0	771	
Wisconsin					16,984	18,490		1,506
Total					280,676	259,951		

State.	1908.				1909.			
	Totals based on smelter reports.	Totals estimated from mine reports.	Differences.		Totals based on smelter reports.	Totals estimated from mine reports.	Differences.	
			Smelter excess.	Mine excess.			Smelter excess.	Mine excess.
Arizona	152	339		187	2,862	2,989		127
Arkansas	2,002	605	1,397		135	510		375
California	27	0	27					
Colorado	29,907	15,065	14,842		23,374	25,605		2,231
Idaho	581	19	562		901	676	225	
Illinois	298	1,717		1,419	675	2,163		1,488
Iowa	516	395	121			35		35
Kansas	8,628	14,119		5,491	9,185	11,445		2,260
Kentucky	341	0	341		22	56		34
Maine	0	0						
Missouri	123,655	107,404	16,251		140,811	130,162	10,649	
Montana	900	820	80		4,725	4,680	45	
Nevada	398	558		160	825	1,507		682
New Jersey	47,643	67,165		19.522	63.307	82,510		19,203
New Mexico	616	1,788		1.172	5,216	6,543		1,327
Oklahoma	2,235	4,529		2.294	3,008	7.806		4,798
Tennessee	341	344		3	695	596	99	
Texas	0	18		18				
Utah	282	730		448	5,960	4,930	1,030	
Virginia	910	705	205		58	58		
Wisconsin	18,598	18,206	392		21,414	23,152		1,738
Total	238,030	234,526			283,173	305,423		

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[a] For 1906 only those States for which there are both smelter and mine reports are taken in order that the discrepancies may aid in explaining the differences in later years. No allowance is made for zinc from these States recovered in 1906 in the form of pigments.

The smelter state totals represent actual recovery and are found by summing up the total production reported by all companies for each State, respectively, all pigments being recalculated back to equivalent metallic zinc on the basis of average analysis of product. In compiling the mine totals each producing property is requested to report actual tonnage of zinc ores and concentrates shipped, and from this the zinc content is reckoned by assay value. From that zinc content 12 to 25 per cent, according to the character of the ore, is deducted for smelting losses, and the remainders thus obtained from all the producing properties in each State are combined to afford the total for the respective States. It is clear that by either method the correctness of the totals is dependent upon complete and correct returns from every producing mine and smelter. It is further essential to the correctness of the mine totals that the assay content and the theoretical recovery be correctly estimated. Theoretically, the state totals, as compiled from smelter reports and from mine reports, respectively, should in the long run agree fairly closely. As a matter of fact, for any year, they show considerable divergence. These discrepancies, giving rise to "smelter excess" or "mine excess," may be the result of one cause or of a combination of causes, among which are: Lag in the smelting of the ore resulting in accumulation of ore stocks at the smelters; lag in the mining, owing to which the smelter depletes its ore stocks; error in calculating metallic contents from assay and in estimating recovery, and error in exact distribution of ore, by States, according to source.

Of these sources, the greater discrepancies arise from erroneous distribution by the smelters, in particular as among the States in the Joplin region and in the upper Mississippi Valley region. Smelters using ore from the Joplin region are prone to credit it to Missouri because bought through their agents at Joplin. Similarly in the upper Mississippi region, the ore is apt to be credited to Wisconsin because bought through a Wisconsin buyer. In each region there are companies operating in more than one State but selling ore through a central office—a condition which likewise leads to error in distribution. Another cause for such error, particularly in the upper Mississippi region, is found in the electrostatic and electromagnetic separation plants, the ore from which is naturally credited to the State in which the plant is located.

The smelter reports give the exact annual production of zinc and serve as a check on the mine production, and they also give the form in which the zinc was recovered, whether as spelter or as pigment. The distribution among States by the smelter reports has value as a check on the mine state totals, and also because of the earlier publication, but for exact distribution of zinc production according to origin, recourse must be had to mine reports.

The total production as reported by the smelters for the period 1907–1909 is 801,879 short tons, which is in excess of the production reported by the mines about 2,000 tons, a discrepancy of about one-fourth of 1 per cent.

MINE AND SMELTER STATE TOTALS, 1909.

The mine excess in Arkansas may be due wholly to lag or it may be in part due to erroneous distribution. The mine excess in Colorado is probably due to lag. The smelter excess in Idaho, following a somewhat larger smelter excess in 1908, is probably due in part to erroneous distribution by the smelters and in part to dimunition of ore stocks. The mine excess in Illinois is due to erroneous distribution by smelters, Illinois spelter being partly credited to Wisconsin, as was the similar mine excess in 1908. The same cause is responsible for the mine excess in Kansas following larger mine excesses in 1907 and 1908. For the same period there have been mine excesses in Oklahoma and large smelter excesses in Missouri. The mine excess in Nevada seems to be due to lag, and that in New Jersey over and above the zinc content of the 12,445 tons of ore exported may likewise be attributed to lag in smelting. The smelter excess in Utah follows three years, each showing a mine excess, and seems therefore to be due to lag.

TRADE CONDITIONS.

WORLD'S PRODUCTION.

The world's production of spelter in 1909 was the largest in history, exceeding that of 1907 by 54,422 short tons, or 6.8 per cent. Of this increase, the greater part was contributed by the United States, with a gain of 45,336 short tons, or 21.5 per cent. Smaller gains were made by Great Britain, Germany, and Holland. The output of the United States was 30 per cent of the total production of the world. The following totals, apportioned according to the country where smelted and not according to the source of the ore, are taken from the annual statistical publication for 1909 of the Metallgesellschaft, the Metallurgische Gesellschaft A.-G., and the Berg- und Metallbank Aktiengesellschaft, of Frankfurt-am-Main, Germany.

The world's production of spelter, 1904–1909, by countries, in short tons.

Country.	1904.	1905.	1906.	1907.	1908.	1909.
Australia	....	....	1,131	1,098	1,198	....
Austria and Italy	10,192	10,315	11,883	12,522	14,063	13,931
Belgium	154,314	160,496	168,067	170,307	181,851	184,194
France and Spain	54,107	55,524	59,293	61,438	61,512	61,859
Germany:						
Rhine district	72,083	74,127	75,729	77,459	80,670	82,863
Silesia	138,538	143,243	150,282	152,611	158,328	159,731
Great Britain	50,949	56,140	57,971	61,286	60,029	65,422
Holland	14,442	15,176	16,150	16,526	19,017	21,548
Poland	11,693	8,422	10,595	10,735	9,740	8,758
United States	186,704	203,849	224,770	249,860	210,424	255,760
Total	693,022	727,292	775,871	813,842	796,832	854,066
United States percentage of world's production	26.9	28.0	28.9	30.7	26.4	29.9

PRODUCTION OF SECONDARY SPELTER IN EUROPE.

The following table of the production of secondary spelter in Europe is calculated to short tons from a table published by Rudolf Wolff, Kreuger & Co., of London. It includes the output of the larger regular producers only. The production of the United States is included for comparison:

Production of secondary spelter in Europe and United States, 1905–1909, in short tons.

	1905.	1906.	1907.	1908.	1909.
Austria-Hungary	3,505	3,674	3,931	3,315	3,102
Belgium	4,044	4,473	3,620	4,295	3,564
France	14,304	14,898	15,130	20,309	24,067
Germany	9,689	11,040	11,316	13,273	14,943
Great Britain	7,913	7,644	7,168	8,714	8,454
Holland	2,268	2,800	2,957	2,923	2,184
Russia	1,680	....	1,680	1,680	....
United States	....	....	18,841	16,970	33,040
Total	43,403	44,529	64,643	71,479	89,354

IMPORTS AND EXPORTS.

WAREHOUSE TRANSACTIONS.

Zinc imported into the United States as metal or in ore may be entered for immediate consumption, in which case the duty is paid and the zinc goes direct to the consumer; or it may be entered for warehouse, bond being given for double the amount of the estimated duty. From warehouse the zinc may be withdrawn for consumption by payment of duty, or it may be smelted in bond, finally being either withdrawn for consumption or exported from warehouse with cancellation of bond. The zinc entered for immediate consumption and that withdrawn from warehouse for consumption make up the table below of imports for consumption which are expressed in the same terms in which they were imported. The zinc imported for consumption may be actually used in the country or it may be manufactured and exported, in which case the manufacturer is entitled to the benefit of a drawback of 99 per cent of the duties paid. In the table below showing foreign zinc exported in manufactures with benefit of drawback, the zinc is shown in the form in which it was originally imported. On account of diversity of form it is not feasible to show the articles exported with benefit of drawback. The foreign zinc given in the table below as exported from warehouse is likewise shown in the form in which it was imported and entered for warehouse. A somewhat more detailed explanation of warehouse transactions is given in the chapter on lead in this volume. The following tables of imports and exports of zinc are made up from the publications and records of the Bureau of Statistics.

The quantity of zinc remaining in warehouse at the close of the years previous to 1909 has been negligible, but since all zinc ore became dutiable on August 6, 1909, the quantity of bonded zinc has largely increased. The zinc ore remaining in warehouse December 31, 1909, is given by the Bureau of Statistics as 2,813 short tons, the zinc content being 2,269,055 pounds.

IMPORTS.

Zinc imported and entered for consumption in the United States, 1902–1909, in short tons.

Year.	Block or pigs.		Sheets.		Old.		Value of manufactures.	Total value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.		
1902..........	448	$36,536	68	$8,339	157	$8,299	$32,708	$85,882
1903..........	202	19,161	129	8,537	163	11,772	10,376	49,846
1904..........	341	34,211	17	2,230	36	3,247	10,394	50,082
1905..........	428	46,295	14	1,953	86	5,110	8,253	61,611
1906..........	1,021	240,632	22	3,236	79	7,647	2,904	254,419
1907..........	1,709	220,474	52	7,158	122	8,582	8,516	244,730
1908..........	776	78,160	37	4,570	37	2,014	5,645	90,389
1909..........	9,419	805,087	117	13,510	238	9,999	6,488	835,084

The foregoing figures are exclusive of the quantity and value of zinc dust imported for consumption. Prior to August 6, 1909, zinc dust was entered free of duty under "articles in a crude state used in dyeing and tanning," and as such was not separately enumerated by the Bureau of Statistics. Since the date mentioned, zinc dust bears a duty of $1\frac{5}{8}$ cents per pound, and is separately enumerated under "imports for consumption," though included with spelter in the monthly summaries of general imports. The imports for consumption of zinc dust for the period August 6 to December 31, 1909, were 431,660 pounds, valued at $19,464. This quantity and value is included in the total for the year as given in the table below. The only statistics available for the time before August 6, 1909, are those of foreign countries relating to their exports of zinc dust to the United States. Among these countries are Germany, Belgium, France, Holland, and Denmark, but only in the reports of the first-mentioned country are the exports of zinc dust segregated from other exports. Germany furnishes much the larger part, amounting to about 95 per cent of the total imports of zinc dust; and for this reason the following table of zinc dust exports from Germany to the United States, compiled from the annual Statistik des Deutschen Reichs, Answärtiger Händel, gives a fair idea of the total consumption of zinc dust in the United States for that period.

Imports of zinc dust from Germany into the United States, 1906–1909, in pounds.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
1906[a]	1,818,576	$108,052	1908	2,625,238	$136,136
1907	1,893,090	106,386	1909	2,520,740	130,662

[a] March–December, 1906; for period preceding, zinc dust is not separately enumerated.

In view of the general interest in the importation of zinc ores, a table is given below, showing the entry of such ores from Mexico and Canada for 1904–1909 by calendar years. These general imports of zinc ores differ from "imports for consumption" by the difference in stock in bonded warehouse at the beginning and close of the year. The statistics of general imports as published by the Bureau of Statistics are based on "consular invoice" or "declaration," which is a close approximation only to actual weights and values. The true weights and values of all dutiable articles are determined when the duties are paid, and the correction is applied as "additions by liquidation" or "deductions by liquidation." On free articles this correction is not made. Previous to 1909 zinc ore was in large part undutiable, and in that part of 1909 previous to August 6 a portion of the imports of zinc ore was free. The correction by liquidation for the dutiable zinc ore imported during 1909 and also the transfer from the declared free to the dutiable class are shown in the table. Inasmuch as this correction takes the form of "addition," it shows that the actual imports of zinc ore for preceding years exceed the figures in the table by an unknown quantity. Beginning with August 6, 1909, the corrections by liquidation apply to the total imports, thereby giving exact figures of such imports.

General imports of zinc ore, 1904–1909, in short tons.

Source.	Calamine (free).	All other (dutiable).	Total.
1904.			
Canada			
Mexico		2,264	2,264
Total		2,264	2,264
1905.			
Canada	913	3,150	4,063
Mexico	6,180	11,894	18,074
Total	7,093	15,044	22,137
1906.			
Canada	423		423
Mexico	47,778	7,213	54,991
Total	48,201	7,213	55,414
1907.			
Canada		1,112	1,112
Mexico	84,984	17,021	102,005
Total	84,984	18,133	103,117
1908.			
Canada	634	6,772	7,406
Mexico	22,900	23,451	46,351
Total	23,534	30,223	53,757
1909.			
Canada	4,330	5,694	10,024
Mexico	73,599	31,227	104,826
Invoice total	77,929	36,921	114,850
Deduction by liquidation	12,545		
Addition by liquidation		13,964	1,419
Total	65,384	50,885	116,269
Grand total	229,196	123,762	352,958

Imports of zinc oxide, 1901–1909, in short tons.

Year.	Dry.	In oil.	Year.	Dry.	In oil.
1901	1,800	64	1906	2,096	146
1902	1,636	82	1907	2,656	181
1903	1,744	83	1908	2,318	105
1904	1,293	112	1909	3,060	268
1905	1,718	171			

Imports of old brass fit only for remanufacture, 1903–1909, in pounds.

[Average composition about one-third zinc and two-thirds copper.]

Year.	Quantity.	Value.	Year.	Quantity.	Value.
1903	1,216,683	$154,260	1908	2,714,155	$355,335
1904	2,659,054	310,311	1909	4,672,575	579,454
1905	9,676,798	1,169,320			
1906	12,938,205	1,891,126	Total	41,834,485	5,804,559
1907	7,957,015	1,344,753			

EXPORTS.

DOMESTIC EXPORTS.

The practice of the Bureau of Statistics is to class all exports of zinc articles made in this country as domestic exports, whether the zinc be of domestic or foreign origin. Hence the following table of domestic exports is duplicated in part in a later table of foreign zinc in manufactures exported with benefit of drawback. The exports of zinc ore in the table below are of domestic origin and in recent years have all been from one mine in New Jersey. The exports of plates, sheets, pigs, or bars are likewise probably wholly domestic, since as shown later all the zinc in manufactures going out under drawback came in as blocks, pigs, and sheets, and the only manufacturing process which would put any of these into the class of exports referred to is rolling into sheets. But the zinc rolling mills in this country do not use foreign spelter, hence the conclusion that the plates, sheets, pigs, and bars of the table are of domestic origin. The zinc dross exports are no doubt in part of foreign origin, but in what proportion can not be determined. However, they are not duplicated in the drawback table. The exports of manufactures, of which the value is given, include the value of the whole of the manufactures exported with benefit of drawback, as well as whatever manufactures of domestic zinc may be exported.

Exports of domestic zinc ore and of domestic manufactures of zinc, 1902–1909, in short tons.

Year.	Zinc ore.		Plates, sheets, pigs, or bars.		Zinc dross.[a]		Value of manufactures.	Total value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.		
1902	55,733	$1,449,104	3,237	$300,557	....	....	$114,197	$1,863,858
1903	39,411	987,000	1,521	163,379	....	....	71,354	1,221,733
1904	35,911	905,782	10,147	1,094,490	....	....	117,957	2,118,229
1905	30,946	848,451	5,516	682,254	....	....	159,995	1,690,700
1906	27,720	733,300	4,670	583,526	15,887	$1,103,706	204,269	2,624,801
1907	[b] 20,352	579,490	563	75,194	9,593	560,944	186,203	1,401,831
1908	[b] 26,168	877,745	2,640	250,254	8,405	467,403	88,485	1,683,887
1909	[b] 12,455	412,300	2,566	263,010	7,069	477,112	69,751	1,222,173

[a] Not separately enumerated prior to 1906.

[b] The exports consisted wholly of high-grade willemite ore from New Jersey.

Exports of zinc oxide, 1902–1909, in short tons.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
1902	5,358	$433,722	1906	15,578	$1,149,297
1903	7,215	578,215	1907	13,257	1,069,924
1904	8,157	628,494	1908	12,008	845,070
1905	11,280	810,203	1909	14,846	1,026,377

FOREIGN EXPORTS.

By foreign zinc exports is meant the exports of zinc of foreign origin which has been smelted or manufactured in this country and then shipped abroad. The following table, made up from the records of the Bureau of Statistics, shows the total zinc exported from warehouse during the last six years, the exports previous to that period being of insignificant proportions, and also the foreign zinc exported in manufactures with benefit of drawback for the same period. These two items, foreign zinc exported from warehouse and foreign zinc in manufactures exported with benefit of drawback, make up the total foreign zinc going out of the country. Zinc in warehouse and deductions by liquidation being disregarded, the difference between the sum of these two exports of zinc and the total imports of zinc, constitutes the foreign zinc consumed in this country. It must be clearly understood in regard to this table that the zinc was not exported as zinc content of ore and blocks, pigs, etc., but as zinc smelted or manufactured from them. The reason for this is that the zinc in bonded customs warehouse is carried on the records until the bond is canceled, in the same form in which the zinc was entered for warehouse. The zinc content of the foreign ore is, of course, exported as spelter. Under present customs regulations 90 per cent of the total zinc content must be exported to secure cancellation of bond. The quantities of zinc exported from warehouse are exact, but the quantities as given of zinc exported in manufactures under drawback are subject to wastage in manufacturing.

There is no record kept of the form in which the zinc is actually exported, except in case of a portion of the articles manufactured from foreign zinc and exported with benefit of drawback. Unless the zinc be the constituent of chief value, the actual amount of zinc is not recorded. But each shipment on which drawback is claimed is accompanied by a manifest of the imported zinc which was used in making the articles as well as the duty paid thereon. From these manifests is made up the statement of the total quantity of foreign zinc which went into manufactures exported with benefit of drawback, and for this reason the zinc is given in the form in which it was imported.

Exports of foreign zinc, 1905–1909, in pounds.

Year.	Exported from warehouse.					Exported in manufactures with benefit of drawback.
	Ore and calamine, zinc content.[a]		Blocks, pigs, and old.		All other manufactures.	Blocks, pigs, sheets, and all other manufactures
	Quantity.	Value.	Quantity.	Value.	Value.	Quantity.
1905	....	....	38,753	$816	$1,015	....
1906	....	....	2,779	252	1,962	4,469
1907	....	....	17,458	1,023	1,504	3,110,239
1908	....	....	16,748	964	4,635	2,468,365
1909	[a] 655,102	$6,429	12,569	752	521	610

[a] Since August 6, 1909.

CUSTOMS DUTIES ON ZINC ORES.

The tariff act of 1897 contained the following paragraphs

Art. 181. Lead-bearing ore of all kinds, 1½ cents per pound on the lead contained therein, etc.

Art. 183. Metallic mineral substances in a crude state and metals unwrought not specially provided for in this act, 20 per centum ad valorem, etc.

FREE LIST.

Art. 514. Calamine.

Art. 614. Minerals, crude or not advanced in value or condition, by refining or regrinding or by other processes of manufacture.

The contention of various interests regarding the interpretation of these articles has been set forth in preceding reports. The conclusion (T. D. 27891) of the Board of General Appraisers was—

> that the carbonates and silicates of zinc are included within the meaning of the term "calamine" as used in paragraph 514, and that they are free of duty under said paragraph and also under paragraph 614, and that the sulphide of zinc is free under the paragraph last named as crude minerals, etc., subject, however, to the qualification that when lead is found in these ores duty shall be taken on the amount of lead contained therein as described in paragraph 181.

The Government's application for review of the decision of the Board of General Appraisers was brought in the United States circuit court, southern district of Texas, Laredo division, where, April 21, 1908, re United States *v.* Brewster (T. D. 29006), the decision of the board was sustained. The Government took an appeal to the United States circuit court of appeals, fifth circuit, which, January 18, 1909, decided (T. D. 29547) adversely to the Government, affirming the decision of the lower court and sustaining the various decisions of the Board of General Appraisers. Whereupon the Treasury Department issued instructions (T. D. 29563) in accordance with the decision of the court to the collectors of customs, and these instructions held until the going into force, August 6, of the new tariff.

The tariff act of 1909, effective August 6, has the following sections relating to zinc ore, zinc, and to compounds containing zinc:

> PAR. 55. Zinc, oxide of, and white pigment containing zinc, but not containing lead, dry, one cent per pound; ground in oil, one and three-fourths cents per pound; sulfid of zinc white, or white sulphide of zinc, one and one-fourth cents per pound; chloride of zinc and sulphate of zinc, one cent per pound.
>
> PAR. 193. Zinc-bearing ore of all kinds, including calamine, containing less than ten per centum of zinc, shall be admitted free of duty; containing ten per centum or more of zinc and less than twenty per centum, one-fourth of one cent per pound on the zinc contained therein; containing twenty per centum or more of zinc and less than twenty-five per centum, one-half of one cent per pound on the zinc contained therein; containing twenty-five per centum of zinc, or more, one cent per pound on the zinc contained therein: *Provided*, That on all importations of zinc-bearing ores the duties shall be estimated at the port of entry, and a bond given in double the amount of such estimated duties for the transportation of the ores by common carriers bonded for the transportation of appraised or unappraised merchandise to properly equipped sampling or smelting establishments, whether designated as bonded warehouses or otherwise. On the arrival of the ores at such establishments they shall be sampled according to commercial methods under the supervision of government officers, who shall be stationed at such establishments, and who shall submit the samples thus obtained to a government assayer, designated by the Secretary of the Treasury, who shall make a proper assay of the sample, and report the result to the proper customs officers, and the import entries shall be liquidated thereon, except in case of ores that shall be removed to a bonded warehouse to be refined for exportation as provided by law. And the Secretary of the Treasury is authorized to make all necessary regulations to enforce the provisions of this paragraph.
>
> PAR. 194. Zinc in blocks or pigs and zinc dust, one and three-eighths cents per pound; in sheets, one and five-eighths cents per pound; in sheets coated or plated with nickel or other metal, or solutions, one and three-fourths cents per pound; old and worn-out, fit only to be remanufactured, one cent per pound.

Section 24 of the tariff act of 1909 provides for the establishment of bonded smelting warehouses for smelting or refining in bond of ores and crude metals, but makes provision for the withdrawal from same of lead alone. Upon application of the United States Zinc Company the Treasury Department made the following ruling (T. D. 30015):

> TREASURY DEPARTMENT, *September 29, 1909.*
>
> SIR: In a letter dated the 24th instant the department confirmed its telegram of the same date approving the application of the United States Zinc Company to bond as a warehouse of class 7 its works at Pueblo, Colo., for the smelting and refining of imported ores.

As it appears from correspondence with this company that the works have been bonded for the smelting of zinc ores and the exportation of the refined metal, I have to advise you that there is no provision in the tariff act of August 5, 1909, for the remission of duty upon zinc withdrawn for exportation from a bonded smelter, as section 24 of this act provides only for the exportation of lead from bonded smelters. Section 29 of the tariff act of July 24, 1897, provides for the bonding of the works of manufacturers engaged in smelting or refining metals, or both smelting and refining, and for the cancellation of the bonds for the payment of the duty upon the exportation of 90 per cent of the metals smelted or refined.

In the opinion of the department there is nothing inconsistent in the provisions of the two acts in so far as they relate to metals other than lead, and it therefore construes section 29 of the act of July 24, 1897, as remaining in force to this extent, and you are therefore authorized to permit the zinc to be withdrawn from the United States Zinc Company's works, located at Pueblo, as provided therein—that is, the bond given for the exportation of the refined zinc should be canceled upon the exportation of 90 per cent of the zinc as shown by the assay to be in the imported ore and so charged against the bond.

Respectfully,

CHARLES D. NORTON,
Acting Secretary.

SURVEYOR OF CUSTOMS, *Denver, Colo.*

CONSUMPTION

In the following tables, showing the consumption of spelter in the United States and in the world for the period 1898–1909, the figures of foreign consumption are computed from statistics published by the Metallgesellschaft, etc. In those statistics consumption is calculated on the basis of production plus excess of imports over exports or minus excess of exports over imports, and altogether disregards smelter stocks. For the sake of comparison, the consumption of the United States is calculated by both methods. Although in the long run the stocks carried over from one year are consumed in the next and thus are equalized, it can not be gainsaid that for the individual year to take stocks into account gives greater accuracy. To obtain perfectly accurate figures of consumption it would be necessary to consider the stocks in the hands of consumers and dealers and to take into account the secondary spelter consumed. In any event, to the consumption for 1909 as given below, 270,730 tons, there should be added the production of secondary zinc for the year, 34,221 short tons.

Consumption of primary spelter in the United States, 1907–1909, in short tons.

	1907.	1908.	1909.
Supply:			
Stock January 1—			
In bonded warehouses	....	2	9
At smelters	3,824	26,364	19,613
Production	249,860	210,424	255,760
Imports	1,778	881	9,454
Total available	255,462	237,671	284,836
Withdrawn:			
Exports, foreign, from warehouse	9	8	334
Exports, foreign, under drawback	1,555	1,234	....
Exports, domestic	563	2,640	2,566
Stock, December 31—			
In bonded warehouses	2	9	39
At smelters	26,364	19,613	11,167
Total withdrawn	28,493	23,504	14,106
Apparent consumption	226,969	214,167	270,730

World's consumption of spelter, by countries, 1907–1909, in short tons.

[Stocks disregarded except in the United States.]

	1907.	1908.	1909.
Austria-Hungary	34,171	35,925	36,155
Belgium	60,627	74,936	68,343
France	76,720	85,956	73,744
Germany	192,792	198,580	207,232
Great Britain	154,653	152,627	171,408
Holland	4,189	4,188	4,409
Italy	7,496	9,257	9,039
Russia	19,290	19,946	20,282
Spain	5,180	5,290	4,850
Other countries	13,228	11,020	6,614
United States	226,969	214,167	270,730
Total	795,315	811,892	872,806

World's consumption of spelter, exclusive of secondary zinc, 1898–1909, in short tons.

Year.	Stocks considered.	Stocks disregarded.			
	United States.	United States.	Foreign countries.	Total world's consumption.	United States percentage.
1898	108,199	106,185	422,070	528,255	20.10
1899	124,585	123,688	422,181	545,869	22.66
1900	99,399	102,414	420,858	523,272	19.57
1901	141,697	137,789	424,496	562,285	24.51
1902	152,682	154,138	465,391	619,529	24.88
1903	154,381	157,900	480,162	638,062	24.75
1904	180,911	176,894	520,506	697,400	25.36
1905	200,438	198,835	534,285	733,120	27.13
1906	220,781	221,142	556,882	778,024	28.42
1907	226,969	249,511	568,346	817,857	30.51
1908	214,167	207,423	597,725	805,148	25.76
1909	270,730	262,314	602,076	870,390	30.14

Statistics of the use of spelter are not collected by the Geological Survey. The following table is from figures published in the Engineering and Mining Journal, which, though confessedly not complete, will, nevertheless, give an idea of the relative importance of the different uses of spelter for the period included.

Consumption of spelter in the United States, 1906–1909, by uses.

Use.	Percentage of total consumption.				
	1905.	1906.	1907.	1908.	1909.
Galvanizing	50.00	55.00	62.7	62.2	62.7
Brass making	26.00	25.25	18.4	17.2	18.3
Sheet zinc	17.00	16.00	12.4	14.1	12.6
Lead desilverization	1.25	1.00	1.1	1.3	1.0
Other purposes	5.75	2.75	5.4	5.2	5.4
Total	100.00	100.00	100.0	100.0	100.0

PRICES AND VALUE.

The year opened with spelter at 5 to 5.02½ cents per pound at St. Louis. In the early part of February a decline set in, reaching the lowest point of the year at 4.52½ cents early in March. A long advance, largely due to imminent tariff legislation, brought the price up to 6.27½ cents at the end of October, and this was the high price for the year. The year closed with spelter selling at 6.05 to 6.07½ cents per pound. The average price for prime western spelter at St. Louis in 1909 was 5.4 cents per pound, as compared with an average of 4.7 cents per pound at New York in 1908. These are the figures used by the United States Geological Survey in calculating the value of the domestic production of primary spelter for those years.

The London spelter market pursued an analogous course, but was more directly affected by the zinc convention and by the dissolution of the Galvanized Sheet Iron Association, and less affected by the new tariff in the United States. The market opened at £21 5s. (4.59 cents per pound), sinking later in January to £20 17s. 6d. (4.51 cents per pound), the lowest price of the year. With minor oscillations the market rose until the high mark was reached in October at £23 5s. (5.02 cents per pound). The year closed at £23 to £23 2s. 6d. (4.97 to 5 cents per pound). The average price for the year was £22 3s. 7d. (4.8 cents per pound), an increase of 0.43 cents per pound as compared with the average price for 1908.

The value of the 1909 production of domestic primary spelter, 230,225 short tons, based upon the average St. Louis price, was $24,864,300, as compared with 190,749 tons valued at the average New York price at $17,930,406 in 1908, and with 223,745 tons valued at $26,401,910, at the average New York price in 1907.

The following table, giving highest and lowest prices of spelter in each month for the years 1902–1909, inclusive, is based on figures in the Iron Age previous to 1906. For 1906 and later, the figures are based on the daily quotations in the Engineering and Mining Journal. Previous to 1909 the quotations are from New York City, but for 1909 St. Louis prices are taken.

Monthly price range of prime western spelter, 1902–1909.

[Cents per pound.]

Year.	January.		February.		March.		April.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
1902	4.30	4.25	4.25	4.00	4.35	4.20	4.45	4.40
1903	4.90	4.55	5.05	4.97	5.75	5.05	5.75	5.50
1904	5.10	4.90	5.10	4.95	5.20	5.05	5.27	5.20
1905	6.20	6.10	6.15	6.10	6.15	5.87	6.00	5.75
1906	6.70	6.00	6.15	6.05	6.35	6.10	6.15	6.05
1907	6.80	6.70	6.90	6.70	6.90	6.75	6.80	6.55
1908	4.60	4.25	4.85	4.55	4.80	4.60	4.70	4.60
1909	5.20	5.075	5.075	4.525	4.625	4.55	4.95	4.60

Year.	May.		June.		July.		August.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
1902	4.65	4.40	4.85	4.80	5.35	5.05	5.50	5.35
1903	5.80	5.75	6.25	5.75	6.25	5.87	6.00	5.80
1904	5.22	4.95	4.95	4.75	4.90	4.87	5.07	4.90
1905	5.70	5.40	5.35	5.25	5.60	5.25	5.80	5.60
1906	6.10	5.90	6.20	6.00	6.05	5.97	6.05	6.02
1907	6.60	6.35	6.45	6.35	6.35	5.85	5.90	5.50
1908	4.675	4.55	4.675	4.45	4.70	4.40	4.775	4.65
1909	5.125	4.875	5.325	5.10	5.325	5.17	5.675	5.325

Monthly price range of prime western spelter, 1902–1909—Continued.

Year.	September.		October.		November.		December.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
1902	5.50	5.30	5.50	5.40	5.35	5.10	5.00	4.50
1903	6.10	6.00	6.12	6.00	6.00	5.25	5.25	4.65
1904	5.15	5.07	5.37	5.15	5.80	5.37	6.12	5.80
1905	5.95	5.75	6.15	6.00	6.25	6.10	6.60	6.40
1906	6.35	6.05	6.30	6.15	6.45	6.25	6.65	6.45
1907	5.50	5.05	5.55	5.25	5.25	4.50	4.55	4.10
1908	4.825	4.70	4.875	4.75	5.05	4.875	5.15	5.10
1909	5.80	5.55	6.275	5.775	6.275	6.175	6.225	6.00

THE ZINC CONVENTION.

Rumors of the formation of a syndicate to control the European production of spelter were rife during 1908 and very decidedly affected the price of that commodity. Early in 1909, these rumors materialized in the organization of the zinc convention. The purpose of the convention is to fix beforehand, within certain limits, the production of spelter by its members, and, if the market gives evidence that the consumption is not keeping pace with the production, further to curtail production. The convention comprises the Zinkhüttenverband m. b. H. and the Société Anonyme des Mines et Fonderies de la Vieille Montagne. The former association embraces 18 zinc smelting firms in Silesia, the Rhine district, Belgium, and Austria. One large firm, Georg von Giesche's Heirs, does not belong to the association, but acts in concert. The Société Anonyme includes 10 smelters, the majority located in Belgium. The more important English smelters joined the convention late in 1909. The competition of American smelters is for the present regarded as negligible. The convention is to remain in force until the close of 1910, but may be terminated upon a month's notice if outside producers so enlarge their output as to raise the total European production as much as 2 per cent above the limit fixed by the syndicate. If the average price of ordinary brands of spelter remains below £19 per ton (4.11 cents per pound) for six consecutive months, a pro rata reduction of the fixed output is to be made. The output of the German group was limited to 255,700 metric tons in 1909 and to 264,200 metric tons in 1910; and the output of the Franco-Belgian group was not to exceed 174,500 metric tons in 1909 and 176,900 metric tons in 1910. The output of the English smelters under the terms of the agreement is to be approximately 55,000 metric tons annually. The syndicate has exercised a steadying effect upon the European zinc market.

SUMMARY.

	1907.	1908.	1909.
Production of spelter by United States	249,860	210,424	255,760
Consumption of spelter by United States (stocks considered)	226,969	214,167	270,730
Production of zinc by world	813,842	796,832	854,066
Consumption of zinc by world (stocks considered in United States)	795,315	811,892	872,806
Excess of world production over consumption	18,527		
Excess of world consumption over production		15,060	18,740
United States percentage of world production	30.7	26.4	29.9
United States percentage of world consumption (stocks considered in United States)	28.5	26.4	31.0
Rank of United States among spelter-producing countries	First.	Second.	First.
Rank of United States among spelter-consuming countries	First.	First.	First.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN THE UNITED STATES IN 1909.

(MINE PRODUCTION.)

PREFATORY NOTE.

This report for 1909 has been greatly delayed owing to the cooperation of the United States Geological Survey with the Bureau of the Census in obtaining the figures of production for that year. The delay was caused by the considerable detail in which data for the census were desired and by the time necessary for personal visits of field agents in obtaining the added information for census reports.

The following account of the production of gold, silver, copper, lead, and zinc by mines is a part of the annual report on the gold, silver, copper, lead, and zinc industries in the United States. The portion of this general report dealing with mine production has been divided, for the sake of convenience and for distribution in advance, into three sections corresponding to broad geographic divisions of the country. As a part of a comprehensive report devoted to the whole country, each section has a certain system and uniformity of treatment imposed upon it which might not in all cases be necessitated by the local conditions of the particular region with which it deals. Accordingly, the general scope of treatment, the arrangement, the tables, and the units of measurement conform as far as possible with those of the sections devoted to other parts of the country as being best adapted to expression of the features of the mining industry of the entire United States. The short ton of 2,000 pounds is used throughout. The price per unit of the production (gold excepted, which is fixed by law) is based upon the average for the year 1909 of daily New York prices for the metals, as follows:

Gold	per fine ounce (troy)	$20.671834625323
Silver	do	.52
Copper	per pound	.13
Lead	do	.043
Zinc	do	.054

It is to be understood, of course, that the full market values are not received for the metals in ore and intermediate products sold to the custom plants.

The full report on the industries of gold, silver, copper, lead, and zinc embraces the following sections:

Gold and silver (general report).
Copper (smelter production).
Lead (smelter production).
Zinc (smelter production).
Gold, silver, copper, lead, and zinc in the Western States (mine production).
Silver, copper, lead, and zinc in the Central States (mine production).
Gold, silver, copper, lead, and zinc in the Eastern States (mine production).

The first four sections give summary reviews of the respective industries for the United States as a whole, together with general statistics based on returns from mints, refineries, and smelters, and additional data from the mines report; the last three sections give reviews of the industries also for the sections of the country indicated, by States, counties, and mining districts, and the production of each metal as reported directly to the Survey from the mines.

Each of these sections is published as a separate pamphlet and may be obtained by addressing a request to the Director of the United States Geological Survey, Washington, D. C.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN THE WESTERN STATES IN 1909.

(MINE PRODUCTION.)

ALASKA.

By Alfred H. Brooks.[a]

INTRODUCTION.

Placer and lode mining of gold in Alaska in 1909 showed marked progress over that of 1908, both in the amount of actual gold production and in the advances made in preparation for more extensive operations.

The copper output was less than in 1908, chiefly because the low price of this metal did not encourage mining, but nevertheless considerable prospecting and dead work were accomplished.

The delay in issuing patents to coal lands has retarded all industries, especially mining. The high price of coal along the Alaska seaboard, due to the nondevelopment of the coal fields, places a serious tax on the mining industry. It has also had indirect effect on mining by retarding railway construction.

There is no doubt that a serious handicap to placer mining is to be found in the present inadequate mineral-land laws. These tend to discourage the bona fide miner and prospector to the advantage of the speculator, whose principal aim is to obtain control of large areas of prospective placer ground without any real attempt at development.

The Fairbanks placer district is still the largest producer of gold, with the Seward Peninsula as second, and the lode mines of the Juneau district as third. Ketchikan still leads in copper production, but there was also an output in 1909 from Prince William Sound. The continuation of construction work on the Copper River Railway stimulated propecting in the Chitina district.

As in previous years, attempt has been made to base statistics of production, so far as possible, on statements of individual producers—the only reliable source of information. Though the cordial cooperation of most of the important mine operators has been secured, there are still a few large producers and many smaller ones who neglect to reply to the request for information. In the meantime recourse is had to other sources of information. In connection with this work the writer is under special obligations to the many United States commissioners in the Territory, to bank officials, to the agents of the customs service, and to prominent residents for valuable information. All these data have been carefully sifted and the accompanying figures are based upon them. The limit of error of the statement of the total gold production of the Territory is believed to be within 2 per cent. In the crediting of the proper amounts to individual districts, however, the error may in some cases be as high as 5 or 8 per cent. A preliminary statement of the distribution of the gold output has already been published.[a]

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[a] Aid has been rendered in the preparation of this report by E. M. Aten, who assisted in the collection of statistics from placer mines. The data on mining development here presented are all taken from Bulletin 442, which deals with the region in a more detailed way; see Brooks, Alfred H., and others, Mineral Resources of Alaska, 1909, Bull. U. S. Geol. Survey No. 442, 1910.

The following table is an estimate of the total gold production of Alaska since the beginning of auriferous mining in 1880. For the early years the figures are probably very far from being correct, but they are based on the best information now available.

Production of gold, silver, and copper in Alaska, 1880–1909.

Year.	Gold.		Silver.		Copper.	
	Quantity (fine ounces).	Value.	Quantity (fine ounces).	Commercial value.	Quantity (pounds).	Value.
1880	967	$20,000			3,933	$826
1881	1,935	40,000				
1882	7,256	150,000				
1883	14,561	301,000	10,320	$11,146		
1884	9,723	201,000				
1885	14,512	300,000				
1886	21,575	446,000				
1887	32,653	675,000				
1888	41,119	850,000	2,320	2,181		
1889	43,538	900,000	8,000	7,490		
1890	36,862	762,000	7,500	6,071		
1891	43,538	900,000	8,000	7,920		
1892	52,245	1,080,000	8,000	7,000		
1893	50,213	1,038,000	8,400	6,570		
1894	62,017	1,282,000	22,261	14,257		
1895	112,642	2,328,500	67,200	44,222		
1896	138,401	2,861,000	145,300	99,087		
1897	118,011	2,439,500	116,400	70,741		
1898	121,760	2,517,000	92,400	54,575		
1899	270,997	5,602,000	140,100	84,276		
1900	395,030	8,166,000	73,300	45,494	250,000	40,000
1901	335,369	6,932,700	47,900	28,598		
1902	400,709	8,283,400	92,000	48,590	360,000	41,400
1903	420,069	8,683,600	143,600	77,843	1,200,000	156,000
1904	443,115	9,160,000	198,700	114,934	2,043,586	275,676
1905	756,101	15,630,000	132,174	80,165	4,805,236	749,617
1906	1,066,030	22,036,794	203,500	136,345	5,871,811	1,133,260
1907	936,044	19,349,743	149,784	98,857	6,308,786	1,261,757
1908	933,290	19,292,818	135,672	71,906	4,585,362	605,267
1909	987,417	20,411,716	147,950	76,934	4,124,705	536,211
Total	7,867,699	162,639,771	1,960,781	1,195,202	29,553,419	4,800,014

PRODUCTION.

The production and value of gold, silver, and copper for 1908 and 1909 are shown in the following table:

Mine production of gold, silver, and copper, 1908–9.

	1908		1909		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold........fine ounces..	933,290.07	$19,292,818	987,416.76	$20,411,716	+ 54,126.69	+$1,118,898
Silver..............do....	135,672	71,906	147,950	76,934	+ 12,278	+ 5,028
Copper.........pounds..	4,585,362	605,267	4,124,705	536,211	− 460,657	− 69,056

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[a] Bull. U. S. Geol. Survey No. 442, 1910, pp. 31–33.

The value of the gold production of Alaska in 1909 is estimated at $20,411,716 and that of silver at $76,934, and the number of ounces of gold at 987,416.76 and of silver at 147,950. In 1908 the output of gold was valued at $19,292,818. The copper output of Alaska for 1909 was 4,124,705 pounds, valued at $536,211, a decrease from that of 1908 of 460,657 pounds. Though the output of metallic copper in 1909 was less than in 1908, much was accomplished toward the preparation for a large future increase in copper production.

Mine production of gold, silver, and copper in Alaska in 1909, by districts.

Districts.	Gold.		Silver.		Copper.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Fine ounces.		*Fine ounces.*		*Pounds.*	
Pacific coast belt, including southeastern Alaska and Prince William Sound	206,305.64	$4,264,716	54,344	$28,259	4,124,705	$536,211
Copper River and Cook Inlet	12,819.37	265,000	1,406	731		
Yukon Basin	560,182.50	11,580,000	71,329	37,091		
Seward Peninsula and northwestern Alaska	208,109.25	4,302,000	20,871	10,853		
Total	987,416.76	20,411,716	147,950	76,934	4,124,705	536,211

Comparison is made in the following table between the gold production of 1908 and of 1909, by districts:

Value of gold production in Alaska in 1908 and 1909, by districts.

Districts.	1908	1909	Increase (+) or decrease (−).
Pacific coast belt, including southeastern Alaska and Prince William Sound	$3,448,318	$4,264,716	+ $816,398
Copper River and Cook Inlet region	401,500	265,000	− 136,500
Yukon Basin	10,323,000	11,580,000	+1,257,000
Seward Peninsula and northwestern Alaska	5,120,000	4,302,000	− 818,000
Total	19,292,818	20,411,716	+1,118,898

About three-quarters of the gold from Alaska comes from the placer deposits. This ratio will, however, not continue, for the gold production from the auriferous lodes is increasing much more rapidly than that from the placers. The gold output from the siliceous ores is second in value and that from the copper ores third. The value of the gold production from the auriferous lode mines was $3,357,335 in 1908 and $4,117,440 in 1909, an increase of $760,105.

In the following table the sources of the precious metals are indicated:

Sources of gold, silver, and copper in Alaska, 1909, by kinds of ore.

	Tonnage.	Gold.		Silver.		Copper.	
		Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
		Fine ounces.		*Fine ounces.*		*Pounds*	
Siliceous ores	1,496,361	199,181.16	$4,117,440	31,391	$16,323		
Copper ores	34,669	2,014.24	41,638	22,549	11,726	4,124,705	$536,211
Placers		786,221.36	16,252,638	94,010	48,885		
Total	1,531,030	987,416.76	20,411,716	147,950	76,934	4,124,705	536,211

Twelve auriferous lode mines were productive in 1909, the same number as in 1908. Operators of 7 copper mines made shipments of ore, as compared with 8 in 1908.

The tonnage of all the lode mines in 1909 was 1,531,030 short tons and was practically the same as that of 1908, which was 1,528,945 short tons. As compared with the tonnage of 1908 there was an increase of 18,925 short tons in the amount of siliceous ores mined and a decrease of 16,840 short tons in the amount of copper ore mined. Of siliceous ores, 1,496,361 short tons were mined, of which 1,385,891 tons came from the 3 mines of the Treadwell group. The average value per ton of the gold and silver extraction from all siliceous ores was $2.76. For the 110,470 short tons of siliceous ores other than those of the Treadwell group the gold and silver value recovered was $2.56 per ton. The content in silver in siliceous ores was less than 1 per cent of the value of the ore. The total tonnage of copper ore was 34,669 short tons, which yielded an average value of $1.55 in gold and silver per ton and 5.95 per cent of copper.

DREDGING IN ALASKA, 1909.

Eight dredges, large and small, were operated in Alaska in 1909 throughout the season, and 6 more were completed in time to make some production. It is estimated that the total gold production of these dredges had a value of $425,000.

REVIEW BY DISTRICTS.

PACIFIC COASTAL BELT.

SOUTHEASTERN ALASKA.

An increase in the output of the gold mines of southeastern Alaska of $728,714 in 1909 above that of 1908 must all be credited to the Juneau district and came chiefly from the Treadwell group of mines. The copper production in 1909 was smaller than that of 1908.

Juneau district.—Seven mines were productive in the Juneau district in 1908. These are the three mines of the Treadwell group, the Perseverance and the Alaska-Juneau in the Silverbow Basin, near Juneau, and the Eagle River to the north and the Crystal mine to the south of Juneau. No developments were made in the Berners Bay region, though it seems probable that the Kensington and the Jualin mines will soon be put on a productive basis again. There was considerable prospecting in the region lying between Juneau and Berners Bay.

At the Alaska-Treadwell, which is the deepest mine of the Treadwell group, the shaft has been deepened 300 feet and a station cut out at the 1,800-foot level. From the shaft station on the 1,450-foot level, which is at that point 181 feet in the foot-wall country rock of the lode, the main crosscut has been driven to the hanging wall of the ore body and the ore has been developed by drifts and raises. The ore mined during the year came principally from the 1,050-foot, 1,250-foot, and 1,450-foot levels, and in part from the higher levels.

The main shaft of the Seven Hundred Foot mine has now attained a total depth of 1,303 feet. Shaft stations were cut at the 1,050-foot and 1,250-foot levels, and these connect with the corresponding levels of the Treadwell mine.

At the Alaska-Mexican mine the shaft has been sunk 330 feet deeper, giving it a depth of approximately 1,450 feet, and ore was partly developed on the 1,210-foot level. The ore sent to the mill during the year was derived principally from the 990-foot level.

The Ready Bullion shaft has now been sunk a distance of 1,985 feet along the incline. The ore milled during the year was taken mainly fron the 1,350-foot and the 1,500-foot levels. Shaft stations have been cut on the 1,650-foot and 1,800-foot levels, and ore has been partly developed on the 1,650-foot level.

At Nevada Creek on Douglas Island the Alaska Treasure Consolidated Mines Company began driving a double-track tunnel 3,000 feet long to undercut an ore body at a depth of 700 feet.

Operations for the season were commenced at the Perseverance mine on May 28, 1909, and the 100 stamps were kept dropping during the summer and fall months. The main development work has consisted in extending the stopes 500 feet along the trend of the lode, and this work will be continued during the winter months. Construction of a producer-gas power plant was partly completed on the shore of Gastineau Channel, and work on an electric transmission line was begun.

Mining was resumed at the Alaska-Juneau mine, the mainland property controlled by the management of the Treadwell group, early in June, and the 30-stamp mill was kept in continuous operation. The ore was extracted partly from open pits and partly from a "glory hole."

The Ebner and Hallam properties were taken over by a holding company known as the California and Nevada Copper Company.

In the mining belt extending southward from Berners Bay to Juneau the Eagle River mine continued to be the only productive property. The 20-stamp mill was kept operating during the greater part of the year, and a large amount of underground development work was done. The ore extracted came mainly from level 1, which is the working tunnel of the mine. During the year a tunnel was commenced 485 feet below level 1 and was projected to crosscut the ore-bearing zone at this increased depth.

At the head of Canyon Creek, a tributary of Cowee Creek, development work was continued on several claims. On Peterson Creek prospecting work was also continued during the year. Considerable local excitement was created in the early part of the spring by the discovery of quartz stringers carrying free gold in the vicinity of Auk Bay.

A large number of prospects are scattered along the mineral belt between Juneau and Berners Bay, but on most of them little more than assessment work was done.

Little interest was manifested during the year in the prospects located on the southern extension of the Juneau gold belt. The Crystal mine, at Port Snettisham, continues to be the only productive property.

Developments have continued during the year at Limestone Inlet, and some new work has been undertaken near Bishop Point, at the entrance of Taku Inlet.

Sitka mining district.—Active operations continued during the year on the De Groff and Mills properties, on the west coast of Chichagof Island. At the De Groff mine the capacity of the milling plant, which consisted of 4 stamps, was enlarged by the addition of an edge-runner mill. Some difficulty was encountered in the separation of the gold from the ore on account of failure to amalgamate, but sea water was substituted in the batteries and a high extraction was obtained.

Ketchikan mining district.—Near Hollis, on Twelvemile Arm, a 5-stamp mill, built so that an additional battery of 5 stamps can readily be added, was erected on the Julia claim, on Harris Creek. Little interest was taken during the year in other gold prospects in the Ketchikan district, the principal mining activity concerning itself with copper properties.

Early in April work was commenced on the Goodro copper mine, which is situated half a mile from the head of a tidal slough known as the Salt Chuck, at the upper end of Kasaan Bay. A wharf, ore bins, 3,850 feet of tram (in part gravity and in part horse tram), and bunk houses were constructed and the shipment of ore was begun. The ore was derived partly from an open cut on the apex of the deposit and partly from a large chamber stoped out at the end of a tunnel driven 94 feet below the outcrop.

The It mine, at which active development work commenced in 1908, has been a steady producer during 1909, and development and exploration work have been continued. A compressor plant has been built on the beach and a gasoline hoist has been placed in the adit level. An incline was put down here and approximately 250 feet of development work was done on the level 50 feet below the adit level, where two ore bodies were encountered.

On the Mount Andrew mine, which was formerly worked under a lease held by the Brittania Smelting Company, operations have been resumed under the management of the proprietary corporation, the Mount Andrew Iron and Copper Company. Work was commenced in March and an output of shipping ore was maintained. An incline from the working level has been sunk 100 feet; at 68 feet drifts are run to crosscut the ore body known as No. 4.

The Jumbo mine, the property of the Alaska Industrial Company, is the only mine on Hetta Inlet from which ore was shipped during 1909. The ore was extracted between level 2 and the surface. Level 4 is now the main working level. It is 262 feet below level 2.

At Seal Bay, on the south end of Gravina Island, 700 feet of the projected 2,000-foot tunnel have been driven on the War Eagle property. Some development work is reported at Mallard Bay, near the south end of Prince of Wales Island. On the west coast of Dall Island a number of parallel lodes of auriferous chalcopyrite-pyrrhotite ore are said to have been discovered at an altitude of 2,400 feet.

COASTAL REGION FROM CROSS SOUND TO ALASKA PENINSULA.

Mining continued in a small way on the beach placers of Yakataga and other points along the coast, but the annual value of this production probably does not exceed $10,000.

There was less activity in mining and prospecting on Prince William Sound in 1909 than in 1908.

At the Ellamar mine most of the work in 1909 was devoted to the construction of a cofferdam around the ore body, which outcrops at and below the level of high tide. It is expected that with the protection afforded by this dam most of the ore between the surface and the 100-foot level can be removed.

At the Bonanza mine, on Latouche Island, from which shipments were continued, more ore was discovered in the lower level.

From the breast of the tunnel of the Galena Bay Mining Company, on the north slope of Copper Mountain, diamond drilling was undertaken, and at a distance of 200 feet an ore body about 30 feet in thickness is said to have been penetrated.

At Landlocked Bay considerable development work was undertaken, and an ore bunker was constructed at the beach. Near Cordova and Orca prospecting was done on several claims. On Knight Island there was much less prospecting than in 1907 and 1908. On Latouche Island not much work was done outside of the Bonanza mine.

An auriferous quartz vein was opened on the north shore of Port Valdez, just east of Shoup Bay. Prospecting for gold was carried on northwest of McKinley Lake, which lies about 20 miles east of Cordova, and some encouraging finds were reported.

Metal mining in southwestern Alaska was confined to the operations at the Apollo mine on Unga Island, to the prospecting of some closely adjacent ore bodies, to the exploitation of some beach placers on Popof Island, and to the continuation of prospecting of some copper deposits in the Iliamna Lake region. No notable advances were made during 1909 in this part of Alaska.

COPPER RIVER BASIN.

As in previous years, mining was carried on during the open season in the Nizina and the Chistochina placer districts.

The Chitina copper district can not be developed until the railway is completed. At the close of 1909 the Copper and Northwestern Railway had laid 102 miles of track from Cordova. Among the important events of the year was the completion of the aerial tram, about 3 miles in length, at the Bonanza mine, which connects the ore body with Kennicott, the proposed inland terminal of the railway. Some ore was sent down over this tram and constituted the first copper mined in inland Alaska. There was also considerable prospecting of properties situated about 1 mile northeast of the Bonanza and apparently in the same general zone of fracturing.

Development work was reported on properties situated on Dan Creek and on Chitistone River. Some prospecting was also done along the limestone-greenstone contact from McCarthy Creek to Nizina River on a series of claims held under private ownership.

Prospecting and development were carried on in a number of other places in the Chitina Valley—on Kotsina River, at Iron Mountain and Copper Mountain, on Elliott Creek, and on Nugget Creek. Work was done also on Kluvesna Creek, Kuskulana, Chokosna, and Lakina rivers, and Hidden Creek. Most of this was for the purpose of testing ground or was done as assessment work and did not have for its object the exploitation of an ore body.

The operations of the Great Northern Development Company on Kotsina River were mainly of a prospecting character. This company owns a large number of claims scattered along the copper belt as far east as Kennicott glacier and has expended much money in testing its ground.

COOK INLET—SUSITNA REGION.

The Yentna, Valdez, and Sunrise placer districts, all tributary to Cook Inlet drainage, continued their normal gold production in 1909. Of special importance was the discovery of promising auriferous lodes on the Kenai Peninsula and in the Willow Creek region. In the latter district a small stamp mill was successfully operated. The work accomplished in these two fields indicates that lode mining can be successfully carried on.

The Alaska Northern Railway, formerly called the Alaska Central Railway, will open both these fields. Some 72 miles of track has been laid.

YUKON BASIN.

General statement.—The Alaska-Yukon placer districts had in 1909 the most profitable season since mining first began there, nearly a quarter of a century ago. The estimated value of the gold output was $11,580,000, as compared with $10,323,000 in 1908.

While practically all the Alaska-Yukon camps made an increased production in 1909, those of the Tanana Valley were the most prosperous. The various districts tributary to the lower Tanana are estimated to have produced gold to the value of over $10,150,000.

Fairbanks district.—The Fairbanks district made an output estimated at $9,650,000, as compared with $9,200,000 in 1908. The increase was due mainly to the output of a few rich claims on Engineer Creek. Though the district was prosperous and many claims still contain valuable pay streaks, it must not be forgotten that on many of the creeks the days of bonanza mining are numbered. Unless means are at once devised for mining the very large bodies of auriferous gravels whose values are too low for exploitation by present methods the output from these placers will soon decrease.

During 1909 mining was continued on all the creeks that were productive in 1908. There was special activity along the lower courses of Cleary, Vault, and Dome creeks, and as a result a large amount of gold was taken out of the Chatanika Flats. So far as known, Goldstream Creek and its tributaries made the largest production, Dome Creek standing second.

The developments in lode prospecting are the most important features of the year's mining at Fairbanks. Auriferous quartz was discovered in 1908 in the valley of Chatham Creek and in Skoogy Gulch, and in 1909 at several other localities that apparently lie in the same belt.

During the summer of 1909 more or less systematic prospecting of quartz veins was carried on at 10 or more localities, most of them in a zone about 10 miles long stretching northeastward from Pedro Dome and drained by creeks carrying auriferous gravels. The veins that have been opened range from small stringers less than an inch wide to veins 12 feet or more thick. The schists of this belt are much jointed and locally faulted, and the veins occur along joint planes and local fault planes and have themselves been in places much broken and faulted. The rich ore that has thus far been found is chiefly in small stringers, or in veins, the largest nearly 3 feet thick. Valuable deposits are reported to occur at places in the wall rock as well as in the veins.

The auriferous quartz is dull white, shows in places comb structure, and much of it contains visible gold in the hand specimens. Some of the associated minerals are iron pyrites, stibnite, sphalerite, and galena. Complex sulphides containing antimony are probably also present. The specimens collected by the Geological Survey's party show no trace of tellurium, though this mineral has been reported by prospectors.

Development work has been confined to surface prospecting, sinking on the veins to depths of less than 100 feet, and tunneling along them to distances not much exceeding 100 feet. The material has been treated in small lots by means of a small stamp mill established at the town of Fairbanks during the winter of 1909.

Although insufficient development work has been done on these veins to determine definitely their importance, some of them are nevertheless of a character to warrant the effort that is being made to develop them and to encourage the search for other lode deposits in this district.

Other districts of Yukon-Tanana region.—Of the districts adjacent to Fairbanks, Hot Springs and Birch Creek were most prosperous, but mining was also done in the Rampart, Tenderfoot, and Salchaket regions. In the Hot Springs and Birch Creek districts several large plants were operated during most of the season. In addition to the smaller mining enterprises, three dredges were in operation in the Fortymile Basin in 1909. One of these is on the south fork of Fortymile and two are on Walkers Fork. It is significant that dredges are successfully operated in this district—one of the most isolated placer districts of Alaska. The initial cost of these plants is probably double what it would be in some of the other districts, and, moreover, at two of these dredges the ground has to be thawed.

Bonnifield district.—Work was begun on the construction of a large hydraulic plant on Gold King Creek.

Much lode prospecting has been done during the year in the Bonnifield district, which lies about 40 miles south of Fairbanks. Some promising prospects are said to occur in a belt that follows closely the base of the Alaska Range. One large ore body has been reported on Jerome Creek, a tributary of Wood River. Systematic prospecting of this property with the use of a small stamp mill was begun in 1909.

Chandalar and Koyukuk districts.—There was but little placer mining in the Chandalar district in 1909, and interest was centered on lode prospecting. Several quartz veins were opened which carried free gold.

The Koyukuk district, which has been growing in importance as a gold producer, has been developed practically without the aid of outside capital. The productive placers of this district fall into three groups, which appear to mark three auriferous belts and include (1) those of Myrtle, Marion, Missouri, and Gold creeks; (2) those of Vermont, Nolan, and Emma creeks; and (3) those of Mascot Creek. Up to 1907, when the deep placers of Nolan Creek were discovered, mining was confined to shallow deposits. In 1909 probably 90 per cent of the gold was taken from the deep gravels of Nolan Creek. The Koyukuk district is difficult of access and mining costs are high, but in spite of the adverse conditions the value of its gold output in 1909 was more than $400,000.

Innoko district.—In 1909 the Innoko district produced gold to the value of probably $300,000. This indicates that systematic mining has begun. In midsummer placer gold was found on Otter Creek, which flows into the Iditarod, a northeastern tributary of the Innoko. The information at hand indicates that these placers lie in what would be an extension of the Innoko auriferous zone. So far as prospected the gold seems to be more uniformly distributed than in the Innoko gravels. This information appears to form the basis for the "stampede" to the Iditarod which took place from Fairbanks and other points in Alaska late in the summer of 1909. The fact that gold has been found also on the Tuluksak, a tributary of the Kuskokwim, in what appears to be an extension of the Innoko and Iditarod belt, makes this general field attractive to the prospector.

SEWARD PENINSULA.

In 1909 the placer districts of the Seward Peninsula produced gold to the value of $4,302,000, compared with a production of $5,120,000 in 1908. This falling off was largely owing to the fact that many of the richest placers have been mined out and no adequate preparations have been made for exploiting the extensive bodies of low-grade gravels. It is to be expected, therefore, that the value of the annual production will continue to decline until large plants are constructed.

Five large dredges, besides a number of small ones, were operated during the season of 1909. In addition to these, several others were in process of erection. Aside from the work of these dredges the most important mining operations were near Nome, in the Solomon Basin, on Ophir Creek, on the Kougarok and its tributaries, and in the Fairhaven precincts. The shortage of water for most of the large enterprises forced many miners who had previously worked for companies to seek employment by working for themselves. As a result, there were more small mining operations in 1909 than there had been for years.

ARIZONA.

By V. C. Heikes.

PRODUCTION.

There were 268 producing mines reported in Arizona during 1909, of which 25 were placers. The value of the combined yield of these mines was $44,053,023 for gold, silver, copper, lead, and zinc. Although copper production increased more than 6 per cent, Arizona, which was the leading copper producer in 1908, was second to Montana in 1909. The material increase in gold production may be credited to the siliceous ores, as the output from copper ores decreased. Mines in Cochise, Mohave, Yavapai, and Yuma counties produced most of the gold, and the greatest increase was in Yuma County; the production was also larger in Mohave, Pinal, and Maricopa counties. A very small part of the gold output was credited to placers. Copper production increased generally, the only important decrease being in Graham County. There was a slight increase in output of lead, the production being small, except in Cochise County. Zinc ore was produced in Cochise and Mohave counties. Arizona made a gain of more than $2,000,000 in value of total output in spite of decreases made in Graham and Yavapai counties. Ores aggregating 216,910 tons and 1,220 tons of old tailings, treated at cyanide and amalgamation plants, produced gold precipitate and bullion, which yielded more than half of the total gold and nearly one-tenth of the silver, with a total value of $1,535,093, or an average value of $7.04 per ton. There was, in 1909, an increase, compared with 1908, of $118,756 in the total value of gold and silver recovered from ores and tailings. At concentration mills 1,485,724 tons of ore produced 248,969 tons of concentrates, which was 30,957 tons more ore, but 3,636 tons less concentrates, than in 1908. The concentrates, containing gold, silver, copper, lead, and zinc, were valued at $8,179,115, or a total average value of $32.85 per ton. The ore shipped directly to the smelters aggregated 2,184,432 tons, valued at $34,308,396 for the gold, silver, copper, lead, and zinc, and it averaged $15.70 per ton. The metal contents recovered from old slag and flue dust and some copper precipitates, aggregating 141,669 tons, are included in the crude ore totals. Compared with the figures of 1908, the tonnage of ore smelted increased 274,354 tons in 1909.

The statement of production for 1908 and 1909, showing increase and decrease, and valued at each year's average commercial prices, is as follows:

Mine production of gold, silver, and associated metals in Arizona in 1908 and 1909.

Metal.	1908		1909		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold.............fine ounces..	117,646.89	$2,431,977	132,426.56	$2,737,500	+ 14,779.67	+ $305,523
Silver....................do....	2,808,450	1,488,478	2,601,161	1,352,604	− 207,289	− 135,874
Copper..............pounds..	285,858,133	37,733,273	303,899,461	39,506,930	+18,041,328	+1,773,657
Lead......................do....	3,008,583	126,360	3,098,083	133,218	+ 89,500	+ 6,858
Zinc.......................do....	678,446	31,887	5,977,237	322,771	+ 5,298,791	+ 290,884
Total..................	....	41,811,975	....	44,053,023	....	+2,241,048

Arizona's production of ore and its content for five years are as follows:

Total tons of ore sold or treated in Arizona in 1904-1909, and total content of gold, silver, and associated metals.

Year.	Tonnage.	Gold.	Silver.	Copper.	Lead.	Zinc.	Total value.
	Short tons.	*Fine ozs.*	*Fine ozs.*	*Pounds.*	*Pounds.*	*Pounds.*	
1904..................	2,305,938	168,274.00	2,314,940	199,481,044	1,779,967	....	$29,816,840
1905..................	2,678,059	135,412.00	2,605,712	228,418,679	4,940,910	140,000	40,246,861
1906..................	3,585,089	143,416.55	3,026,438	266,831,864	5,638,735	....	56,812,355
1907..................	3,567,133	126,612.52	2,511,897	254,879,489	4,660,684	228,490	55,511,560
1908..................	3,696,938	117,646.89	2,808,450	285,858,133	3,008,583	678,446	41,811,975
1909..................	4,029,955	132,426.56	2,601,161	303,899,461	3,098,083	5,977,237	44,053,023

The smelting plants operated in 1909, distributed by counties, were as follows: Cochise, 3; Gila, 2; Graham, 3; and Yavapai, 1—a total of 9 in 1909, against 8 in 1908. Two new copper plants were erected and they produced matte, which was shipped during 1909. These were the Arizona-Commercial, at Globe, and the Arizona-United, at

Johnson. The smelter at Humboldt, in Yavapai County, was prepared for resuming operations in 1910. The bulk of the copper ores was smelted at Arizona smelters. Zinc ores and concentrate were largely shipped to Oklahoma buyers, but some went to Colorado plants in 1909. Nearly all the lead ores were purchased by the smelter at El Paso, Tex., but some were shipped to Needles, Cal. Much of the gold bullion and gold precipitates from cyanide mills was shipped to the Selby Works, near San Francisco, and some was sold to eastern refineries. The Government mints at Denver and San Francisco received the larger part of the refined gold and silver bullion.

ORE PRODUCTION IN 1909.

Ore mined and sold or treated in 1909 aggregated 4,029,955 tons, and in addition a relatively small quantity of old tailings and slag were re-treated. The production increased 333,017 tons in quantity and decreased in value per ton from $11.30 in 1908 to $10.92 in 1909. Production of siliceous ore decreased from 375,500 tons in 1908 to 237,078 tons in 1909. The greatest quantity of this kind of ore was produced in Cochise County in 1908, Yuma County leading in 1909. Copper ore increased from 3,315,140 tons in 1908 to 3,741,713 tons in 1909. Graham County had the greatest output of copper ore, Cochise County following. Lead ore increased in output from 5,519 tons in 1908 to 27,658 tons in 1909; zinc ore increased from 695 tons in 1908 to 6,696 tons in 1909; copper-lead ore increased from 84 tons in 1908 to 16,810 tons in 1909. The average yield per ton of gold and silver in siliceous ore in 1909 was $7.31, as against $5.32 in 1908; in copper ore, 48 cents, as against 53 cents in 1908; in lead ore, $6.39 in 1909, as against $15.64 in 1908; in copper-lead ore, $18.47 in 1909, as against $23.49 in 1908; and in zinc ore, $8.78 in 1909, as against $2.91 in 1908. The total tonnage, by kinds of ore sold or treated, in Arizona during 1909 is shown in the following table:

Subdivision of tonnage of ore sold or treated in Arizona in 1909, by counties, in short tons.

County.	Siliceous ore.	Copper ore.	Lead ore.	Zinc ore.	Copper-lead ore.	Total.
Cochise	61,566	1,134,955	25,574			1,222,095
Coconino and Maricopa	3,819	25				3,844
Gila	364	445,288	36			445,688
Graham	1,804	1,565,116	69			1,566,989
Mohave	23,466	502	158	6,696		30,822
Pima	22	296,701	1,460		440	298,623
Pinal	11,041	25,600			3	36,644
Santa Cruz	175	1,777	5			1,957
Yavapai	36,071	270,770	281		16,367	323,489
Yuma	98,750	979	75			99,804
Total	237,078	3,741,713	27,658	6,696	16,810	4,029,955
Value per ton in gold and silver	$7.31	$0.48	$6.39	$8.78	$18.47	

GOLD.

The increase of gold output in 1909 may be credited to the lead ores, zinc ores, and copper-lead ores, as the total recovered from copper ores decreased. Most of the gold came from mines in Cochise, Mohave, Yavapai, and Yuma counties. The greatest increase was in the output of Yuma County; other increases were in Mohave, Pinal, and Maricopa counties. Yavapai County fell short of its usual gold output. In 1909, Arizona mines produced 132,426.56 fine ounces of gold, valued at $2,737,500. Compared with the figures of 1908, this indicated an increase of $305,523. Milling plants equipped for treating the ores by the cyanide process and by amalgamation extracted 67,769.45 fine ounces from 216,910 tons of ore, averaging $6.46 per ton. Some of the mills, especially those in Yavapai County, where cyanide and amalgamation methods are in use, are also equipped to save concentrate. Three classes of concentrate were shipped to smelters. The auriferous iron sulphide is produced in greatest quantity and contained more gold than copper-lead and lead concentrates, which also yielded important totals. At milling plants equipped only for concentration, 1,485,724 tons of ore were treated, yielding 248,969 tons of concentrates, containing 11,619.18 ounces of gold, valued at $240,189, or an average value per ton of $0.96. The concentrates were of three kinds—copper, lead, and zinc. Copper concentrates in largest quantities were produced at mills near Clifton, in Graham County, but the amount of gold yield was not important, nor was it from lead and zinc concentrates produced at one mill in Cochise County. Smelting ores shipped directly to the smelters aggregated 2,184,432 tons, yielding 51,652.09 ounces of gold, valued at $1,067,745, or an average value per ton of $0.49. Gold production from placers decreased from $30,937 in 1908 to $28,648 in 1909. Yavapai, Yuma, and Pima County placers produced the largest quantities of placer gold. Yavapai County made a decided increase in placer yield, and it may be expected in the next two years to make greatly increased production. Gold dredges were reported to be under construction in several parts of Arizona. The large dredge built in 1909 on Colorado River, near the Arizona side, opposite Eldorado Canyon, Nev., was of the suction type and rated at 7,000 yards daily, but this is probably a high estimate. It was built to work the sand bars and failed on first test to extract the fine gold. It was subsequently carried from its moorings by high water and was wrecked during the spring of 1910. The active development of the gold region of western Arizona continued during 1909 with most encouraging results, especially in Yuma and Mohave counties (where new properties have been opened), in Payson district in northern Gila County, in the eastern section of Graham County, and in Cochise County.

Source of gold production in Arizona by kinds of ore in 1909, by counties, in fine ounces.

County.	Placers.	Siliceous ore.	Copper ore.	Lead ore.	Zinc ore.	Copper-lead ore.	Total.
Cochise		3,567.22	18,239.69	2,233.09			24,040.00
Coconino and Maricopa	33.57	1,178.66					1,212.23
Gila	3.24	159.10	1,015.77	51.00			1,229.11
Graham	14.99	430.30	1,417.95	8.00			1,871.24
Mohave	66.52	15,366.71		88.83	1,717.00		17,239.06
Pima	106.42	13.98	194.39	37.00		25.00	376.79
Pinal		2,570.04	13.43				2,583.47
Santa Cruz	4.41	80.56	13.38				98.35
Yavapai	752.62	13,187.36	18,980.00	229.95		12,914.83	46,064.76
Yuma	404.07	37,035.95	271.53				37,711.55
Total	1,385.84	73,589.88	40,146.14	2,647.87	1,717.00	12,939.83	132,426.56

SILVER.

The yield of silver in Arizona in 1909 was 2,601,161 fine ounces, valued at $1,352,604, a decrease of 207,289 ounces. Silver is largely produced as the by-product from copper ores, and its increase in production largely depends on the increase of copper and lead ores. No very high-grade silver ores have been found in recent years since the surface ore deposits have been exhausted. In many instances at depth these ores have been replaced by copper ores carrying silver. The silver yield from siliceous ore in 1909 was 407,757 ounces, or about one-half the quantity produced from the same source in 1908. The greatest decrease was in Cochise County. Copper ores yielded 1,830,998 ounces of silver, half of which was from Cochise County mines, and lead ores yielded 234,709 ounces. The total silver from copper ores was 53,732 ounces greater and from lead ores 105,659 ounces greater than in 1908. The crude ore treated at smelters, 2,184,432 tons in quantity, yielded 2,204,069 ounces of silver, averaging 1.01 ounces per ton. Ore treated at amalgamation and cyanide mills aggregated 216,910 tons and yielded 258,029 ounces of silver, or an average of 1.19 ounces per ton. At concentration mills 248,969 tons of concentrates were made, containing 135,657 ounces of silver, or an average of 0.54 ounce per ton. Cochise County concentrate produced most of the silver, and Yavapai County was second in total yield.

Source of silver production in Arizona, by kinds of ore, in 1909, by counties, in fine ounces.

County.	Placers.	Siliceous ore.	Copper ore.	Lead ore.	Zinc ore.	Copper-lead ore.	Total.
Cochise		293,680	961,814	198,896			1,454,390
Coconino and Maricopa	5	266	52				323
Gila	1	12,508	142,826	158			155,493
Graham	3	20,896	66,755	428			88,082
Mohave	11	29,064	1,890	3,856	44,841		79,662
Pima	17	948	159,671	25,818		13,333	199,787
Pinal		11,306	6,593			507	18,406
Santa Cruz	1	1,655	6,244	810			8,710
Yavapai	80	23,547	483,820	2,300		68,833	578,580
Yuma	65	13,887	1,333	2,443			17,728
Total	183	407,757	1,830,998	234,709	44,841	82,673	2,601,161

COPPER.

In 1909 the output of copper amounted to 303,899,461 pounds, valued at $39,506,930. As compared with figures of 1908 this showed an increase of 18,041,328 pounds, which is almost entirely credited to Cochise County mines, Pima County showing the next notable increase. Cochise, Graham, Gila, Yavapai, and Pima counties, named in order of their production, were credited with the greatest yield of copper. Only three counties, Graham, Mohave, and Coconino, had decreases recorded against them for 1909. Forty-six per cent of the production of copper, or 140,810,472 pounds, valued at $18,305,361, was produced from the mines in Cochise County. The crude shipping ores treated at smelters in 1909, aggregating 2,184,432 tons (including lead and zinc ores), yielded 244,040,367 pounds of copper, or an average of 111.72 pounds per ton. Included in this crude ore to smelters was the metallic content of 141,669 tons of old smelter slag and flue dust resmelted, from which were recovered 8,189,356 pounds of copper. There were also 169,008 pounds of copper recovered from tailings by leaching and the use of scrap iron as a precipitant. The total quantity of concentrates produced in Arizona was 248,969 tons, of which all but a small tonnage containing lead produced in Cochise, Yavapai, Pinal, and Mohave counties, yielded 59,859,094 pounds of copper, an average of 240.42 pounds per ton. Copper contained in concentrates was separated from 1,485,724 tons of ore, which yielded an average of 2.02 per cent of copper. The ore was mined in the following counties: Graham, Gila, Pinal, Cochise, Pima, and Yavapai, given in the order of importance. In the classification of the kinds of ore produced in 1909 the copper ores carried the bulk of the copper. Siliceous ores yielded 308,446 pounds, of which nine-tenths was from ores mined in Cochise County; the average content of copper was 0.06 per cent. Lead ores contained 64,785 pounds, averaging 0.11 per cent. Copper-lead ores contained 262,154 pounds, an average of 0.77 per cent. Copper was associated with the lead ores produced in Cochise, Pima, and Graham counties and averaged well with the copper-lead ores of Yavapai, Pima, and Pinal counties.

LEAD.

The output of lead increased from 3,008,583 pounds, valued at $126,360, in 1908 to 3,098,083 pounds, valued at $133,218, in 1909, the increase being from Pima, Yavapai, Cochise, Yuma, and Graham counties. The largest production was in Cochise County, which yielded 2,004,018 pounds, and Yavapai County ranked next with 409,890 pounds. Crude ore shipped to smelters contained 1,977,294 pounds, or nearly two-thirds of the total output. Concentrates containing lead aggregated 7,661 tons and contained 1,120,789 pounds of lead, averaging 146.29 pounds per ton, or 7.31 per cent. The concentrates were produced in Cochise, Yavapai, Pinal, Mohave, and Santa Cruz counties. Yavapai County was credited with the largest total output of lead. The average recovery was small in the county, and the average for Arizona was barely three-tenths of a pound per ton. The mines in this county were also productive of the largest total yield of copper-lead ore. This county, with Pima and Pinal counties, was credited with a total of 507,354 pounds of lead.

ZINC.

Zinc, reported according to its yield of spelter, aggregated 5,977,237 pounds, valued at $322,771, in 1909 as against a yield of 678,446 pounds, valued at $31,887, in 1908. In 1907 the output was 228,490 pounds. The Golconda mine, in Mohave County, produced zinc ores which averaged nearly 50 per cent of zinc. At Tombstone, in Cochise County, a zinc concentrate was shipped separately from the lead concentrate produced at the mill of the Tombstone mines.

MINING INDUSTRY IN ARIZONA IN 1909.

The figures of metal output in Arizona for 1909 suggest that the mining industry was, in general, in a progressive condition, especially since developments have been keeping pace with production. It is stated by the larger companies operating copper mines at Clifton and Bisbee that at greater depths the value and extent of ore bodies are well maintained. The most notable feature of Arizona's copper mining was the development of deposits of low-grade ores in porphyry and schists. The greatest activity has been in the Globe district. The country between Pinal Creek, which runs through the town of Globe, and the Pinal Mountains, which are 20 miles south of Globe, is more or less impregnated with copper, and it is within that district that the most vigorous operations are now being conducted. Some of the properties which are to be worked by large public corporations have been small producers for years, but nowhere have they been prospected at depth, and it is the deeper ores, under corporate management, that will unquestionably tell largely upon Arizona's future production. The large bodies of disseminated copper ores were mainly prospected by churn drills at the angles of 200-foot squares. The assays showed a wide distribution of low-grade ore. This was blocked out by crosscuts and raises at regular intervals, with the result that the estimated quantity of ore is expressed in millions of tons. At Courtland, in Cochise County, and near Mammoth, in Pinal County, large low-grade bodies of copper ore were opened. The opening of zinc sulphide deposits in the Union Basin district of Mohave County at the Golconda mine and in other parts of the same county by allied interests of the United States Mining Company has caused a renewal of activity in the development of the zinc-bearing ores. The reduction plants at Globe have been increased by the blowing in of the Arizona-Commercial Copper Company's 500-ton smelter, which is, however, treating only 125 tons of ore daily. A copper-matting furnace, with a capacity of 125 tons of ore daily, was blown in at Johnson, in Cochise County, and operated for a short period. The smelter of the Consolidated Arizona Company, at Humboldt, in Yavapai County, idle since the latter part of 1907, was being prepared for operation early in 1910. The Needles Mining and Smelting Company, controlled by the United States Smelting and Refining Company, bought the property of the Arizona Mexican Mining and Smelting Company. The purchase included the small smelting plant at Needles, Cal., and several small mines near Kingman, Ariz. By purchase and by bonding a large, though little developed, mining territory, the company is now equipping for exploration. It is making some improvements at the smelting plant and expects to begin smelting operations in the near future. It is also building, adjacent to the smelter, a 200-ton concentrator. The Needles smelter has tributary to it a large territory in California, Nevada, and Arizona which promises well from the mining point of view and whose growth has been retarded by lack of proper milling and smelting facilities. These the company proposes to provide and is confident of being able to build up a large and profitable industry of smelting custom ores augmented by ores from its own mines. Complete results, however, are not expected for at least two years.

During 1909 the Southern Pacific Company extended its railroad to Courtland, in Cochise County, and from Globe to Miami, in Gila County. It is now extending its Phoenix-Kelvin line from Winkelman, in Pinal County. From Twin Buttes, in Pima County, the branch line operating from Tucson is being extended toward Calabasas, in Santa Cruz County. In November, 1909, connection was established with the Southern Pacific and Johnson, in Cochise County, by a new branch line known as the Johnson, Dragoon and Northern Railway. The Santa Fe Railway is connecting its branch railroad line, extended in 1908 to Parker, on the Colorado River, with the main line at Bengal, in San Bernardino County, Cal. The Shannon Railway, 10 miles long, from the Shannon mines at Metcalf to its smelter at Clifton, in Graham County, was nearly completed at the end of 1909. New electric-power plants were built and put in operation, notably at Kingman, in Mohave County, and on Fossil Creek, in Yavapai County. When this electric power is ready for distribution from the Government dams in Arizona to the surrounding camps, this will do much to cheapen the cost of mining. A large electric-power plant is under construction at Hayden, a point on the Arizona-Eastern Railroad, about 15 miles southeast of Kelvin and about 20 miles from the Ray mines in Pinal County. This plant will supply the 8,000-ton mill and smelter and the mines of the Ray Consolidated Company with power.

Mine production of gold, silver, copper, and lead in Arizona in 1909, by counties.

Counties.	Gold.		Silver.		Copper.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Fine ounces.		*Fine ounces.*		*Pounds.*	
Cochise	24,040.00	$496,951	1,454,390	$756,283	140,810.472	$18,305,361
Coconino and Maricopa	1,212.23	25,059	323	168	2,715	353
Gila	1.229.11	25,408	155,493	80,856	39,451,896	5,128,746
Graham	1,871.24	38,682	88,082	45,803	71,826,650	9,337,465
Mohave	17,239.06	356,363	79,662	41,424	313,384	40,740
Pima	376.79	7,789	199,787	103,889	13,400,968	1,742,126
Pinal	2,583.47	53,405	18,406	9,571	673,760	87,589
Santa Cruz	98.35	2,033	8,710	4,529	148,869	19,353
Yavapai	46,064.76	952,243	578,580	300,862	37,125,964	4,826,375
Yuma	37,711.55	779.567	17,728	9,219	144,783	18,822
Total	132,426.56	2,737,500	2,601,161	1,352,604	303,899,461	39,506,930

Counties.	Lead.		Zinc.		Total value.
	Quantity.	Value.	Quantity.	Value.	
	Pounds.		*Pounds.*		
Cochise	2,004,018	$86,173	713,116	$38,508	$19,683,276
Coconino and Maricopa					25,580
Gila	13,442	578			5,235,588
Graham	44,729	1.923			9,423,873
Mohave	113,406	4,876	5,264,121	284,263	727,666
Pima	406,949	17,499			1,871,303
Pinal	9,850	424			150,989
Santa Cruz	3,460	149			26,064
Yavapai	409,890	17,625			6,097,105
Yuma	92,339	3,971			811,579
Total	3,098,083	133,218	5,977,237	322,771	44,053,023

Tonnage of milling and smelting ore and concentrates, and quantity of gold and silver contained in bullion, produced in Arizona in 1909, by counties.

Counties.	Ore to gold and silver mills.			Ore to concentrating mills.
	Quantity.	Gold in bullion.	Silver in bullion.	
	Short tons.	*Fine ounces.*	*Fine ounces.*	*Short tons.*
Cochise	34,833	2,718.52	228,472	18,928
Coconino and Maricopa	3,818	1,178.17	266	
Gila	56	48.52	18	123.976
Graham	178	94.60	15	1,303,963
Mohave	23,298	15,153.09	7,820	
Pima	4	1.94	1	10,791
Pinal	10,594	2,558.46	947	25,849
Santa Cruz	147	55.67	134	
Yavapai	45,309	9,414.72	7,216	2,217
Yuma	98,673	36,545.76	13,140	
Total	216,910	67,769.45	258,029	1,485,724

Tonnage of milling and smelting ore and concentrates, and quantity of gold and silver contained in bullion, produced in Arizona in 1909, by counties—Continued.

Counties.	Concentrates produced.						Total value of concentrates.
	Quantity.	Gold.	Silver.	Copper.	Lead.	Zinc.	
	Short tons.	*Fine ounces.*	*Fine ounces.*	*Pounds.*	*Pounds.*	*Pounds.*	
Cochise	2,169	527.00	58,950	6,200	730.134	713,116	$112,258
Coconino and Maricopa							
Gila	40,399	225.59	30,893	5,982,101			798,400
Graham	200,231	138.00	5,125	52,852,454			6,876,337
Mohave	15	42.20	151	135	387		986
Pima	678	165.09	1,246	340,027			48,264
Pinal	1,385	5.11	2,939	637,310	3,304		84,626
Santa Cruz	8	18.00	1,138	668	330		1,065
Yavapai	4,084	10,498.19	35,215	40,199	386,634		257,179
Yuma							
Total	248,969	11,619.18	135,657	59,859,094	1,120,789	713,116	8,179,115

Counties.	Crude ore to smelter.						Total value.
	Quantity.	Gold.	Silver.	Copper.	Lead.	Zinc.	
	Short tons.	*Fine ounces.*	*Fine ounces.*	*Pounds.*	*Pounds.*	*Pounds.*	
Cochise	1,160,056	20,794.48	1,166,802	140,804,272	1,273,884		$19,395,929
Coconino and Maricopa	26	.49	52	2,715			390
Gila	187,090	951.76	121,524	33,469,795	13,442		4,434,519
Graham	262,848	1,623.65	82,939	18,974,196	44,729		2,545,262
Mohave	7,524	1,977.25	71,680	313,249	113,019	5,264,121	407,992
Pima	287,828	103.34	198,523	13,060,941	406,949		1,820,790
Pinal	201	19.90	14,520	36,450	6,546		12,982
Santa Cruz	1,810	20.27	7,437	148,201	3,130		23,687
Yavapai	275,918	25,399.23	536,069	37,085,765	23,256		5,625,954
Yuma	1,131	761.72	4,523	144,783	92,339		40,891
Total	2,184,432	51,652.09	2,204,069	244,040,367	1,977,294	5,264,121	34,308,396

Tonnage of ore sold or treated, number of deep mines producing, and value of ores in 1908 and 1909, by counties.

Counties.	Ore sold or treated (short tons).		Number of deep mines producing.		Average total value per ton.[1]		Average value per ton in gold and silver.[1]	
	1909	Increase (+) or decrease (−) compared with 1908.	1908	1909	1908	1909	1908	1909
Cochise	1,222,095	+ 85,433	26	38	$16.00	$16.11	$1.23	$1.03
Coconino and Maricopa	3,844	+ 433	5	5	4.13	6.47	3.19	6.38
Gila	445,688	+ 3,258	24	22	11.48	11.75	.32	.24
Graham	1,566,989	+ 58,702	29	23	6.81	6.01	.06	.05
Mohave	30,822	− 45,886	42	29	5.17	23.56	4.13	12.86
Pima	298,623	+165,966	25	29	8.80	6.26	.90	.37
Pinal	36,644	+ 32,748	22	15	7.98	4.12	4.33	1.72
Santa Cruz	1,957	+ 1,005	20	10	25.41	13.27	10.11	3.31
Yavapai	323,489	+ 9,376	67	48	19.81	18.80	4.53	3.83
Yuma	99,804	+ 21,982	19	24	4.82	8.05	4.68	7.82
Total	4,029,955	+333,017	279	243	11.30	10.92	1.05	1.01

[1] Value per ton, placer product excluded.

Number of mines in Arizona classified by chief products in 1909.

Counties.	Total mines producing.	Gold placer mines.	Deep mines.											
			Gold.	Silver.	Copper.	Gold-silver.	Gold-silver-copper.	Silver-copper.	Silver-copper-lead.	Gold-silver-lead.	Silver-lead.	Gold-silver-copper-lead.	Gold-silver-lead-zinc.	Gold-silver-lead-copper-zinc.
Cochise	38	......	......	1	2	5	11	6	2	......	2	8	......	1
Coconino	1	......	......	......	......	......	......	1	......	......	......	......	......	......
Gila	23	1	......	......	......	3	6	8	1	2	......	2	......	......
Graham	25	2	......	......	3	9	7	3	......	......	......	1	......	......
Maricopa	5	1	2	......	......	2	......	......	......	......	......	......	......	......
Mohave	30	1	......	1	......	12	2	1	......	9	2	1	1	......
Pima	30	1	......	......	......	2	8	9	5	2	1	2	......	......
Pinal	15	......	......	......	......	3	4	2	4	1	......	1	......	......
Santa Cruz	11	1	......	......	......	1	5	1	......	1	1	1	......	......
Yavapai	56	8	......	1	......	22	6	2	......	12	1	4	......	......
Yuma	34	10	......	......	......	9	11	1	......	......	3	......	......	......
Total	268	25	2	3	5	68	60	34	12	27	10	20	1	1

PRODUCTION BY COUNTIES.

COCHISE COUNTY.

Mine production of gold, silver, and associated metals in Cochise County, Ariz., in 1908 and 1909.

Metal.	1908		1909		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold .... fine ounces	25,605.76	$529,318	24,040.00	$496,951	− 1,565.76	− $32,367
Silver .... do	1,630,749	864,297	1,454,390	756,283	− 176,359	− 108,014
Copper .... pounds	126,554,764	16,705,229	140,810,472	18,305,361	+14,255,708	+1,600,132
Lead .... do	1,978,097	83,080	2,004,018	86,173	+ 25,921	+ 3,093
Zinc .... do	173,313	8,146	713,116	38,508	+ 539,803	+ 30,362
Total	....	18,190,070	....	19,683,276	....	+1,493,206

Thirty-eight deep-mine operators reported in 1909, 12 more than in 1908. The output of ore was 1,222,095 tons, an increase of 85,433 tons over the output of 1908. The total average value per ton increased from $16 in 1908 to $16.11 in 1909; the gold and silver average value of this ore, which in 1908 was $1.23, decreased to $1.03 in 1909. The largest proportion of the ores, aggregating 1,160,056 tons, containing gold, silver, copper, and lead, was of shipping grade and was smelted at Douglas, Ariz. These ores yielded 20,794.48 ounces of gold, 1,166,802 ounces of silver, 140,804,272 pounds of copper, and 1,273,884 pounds of lead, aggregating in value $19,395,929, at an average value of $16.72 per ton. The remainder of the ore, 18,928 tons in quantity, treated at concentration mills, yielded 2,169 tons of concentrate, containing 527 ounces of gold, 58,950 ounces of silver, 6,200 pounds of copper, 730,134 pounds of lead, and 713,116 pounds of zinc, with a total value of $112,258, and an average value of $51.75 per ton. At mills equipped for amalgamation and cyanide processes, 34,833 tons were treated, and yielded 2,718.52 ounces of gold and 228,472 ounces of silver, valued at

$175,102, an average value of $5.02 per ton. No placer gold was reported in 1909. The lead and zinc production was contained in 25,574 tons of ore, part of which was concentrated, yielding 2,165 tons of concentrate. The concentrate, containing all of the zinc and some of the lead, was shipped with crude ore containing lead to smelters outside of Arizona. The metallic content of slag cleanings and copper precipitates from the old works at Bisbee and some old tailings reconcentrated at Tombstone are included in the county totals. At Douglas, the Copper Queen smelter had in operation during 1909 an average of 7½ blast furnaces and 5.8 converter stands, the plant consisting at the present time of 10 blast furnaces and 8 stands of converters. Experiments were made on reverberatory settling of slags and smelting of flue dust and also on a sintering plant of the Dwight and Lloyd design. Exhaustive investigations were also carried out on chamber and stock losses in flue dust. Mining operations in the county were carried on in 8 districts.

California district.—Five mine operators reported the shipment of 34 tons of ore to smelters, which yielded 594 ounces of silver, 794 pounds of copper, and 21,103 pounds of lead, with a total value of $1,320, at an average value of $38.82 per ton. The small shipments constituting the output were made from the Ajax and the Bernoudy mines and from the surface croppings of 3 other properties.

Cochise district.—Reports from 6 deep mines in 1909 gave a production of 2,809 tons of ore of shipping grade. The total yield was $412 in gold, 2,691 ounces of silver, 210,189 pounds of copper, and 8,421 pounds of lead, with a total value of $29,498, at an average value of $10.50 per ton. The principal mines producing were the Republic, Centurion, and Empire and Princess groups. A number of other shipments were made as tests from mining claims in the district. The Centurion mine produced from cave-like ground on the 225-foot level a rich copper ore resembling that found in the Copper Queen mine of Warren district.

Dos Cabezas district.—The output reported by 4 deep-mine operators aggregated 468 tons. The larger part, or 459 tons, was shipped directly to the smelters, and the remainder, 9 tons, produced a small quantity of gold bullion and 4 tons of concentrate. The total ore mined in 1909 yielded $1,911 in gold, 2,539 ounces of silver, 88 pounds of copper, and 1,256 pounds of lead, having a total value of $3,296, an average value of $7.04 per ton. The principal properties producing were the Red Jacket and the Oneida.

Hereford district.—Production was recorded from 2 properties in the district, which yielded ore of shipping grade aggregating 202 tons, containing $385 in gold, 3,988 ounces of silver, and 28,610 pounds of copper, having a total value of $6,178, an average value of $30.58 per ton.

Huachuca district.—Extensive examinations were made in 1909 of the Sitric mines by the Copper Queen Consolidated Company, looking for large bodies of siliceous ore for converter lining.

Teviston district.—Three operators reported a production of siliceous ore, containing gold and silver. There were 12 tons shipped from the district, which contained $434 in gold and 10 ounces of silver, aggregating $439 in value, at an average value of $36.58 per ton.

Tombstone district.—The output reported from 5 deep mines aggregated 27,123 tons of ore, yielding $47,119 in gold, 201,700 ounces of silver, 27,706 pounds of copper, 1,535,637 pounds of lead, and 713,116 pounds of zinc, having a total value of $260,145, an average value of $9.59 per ton. The larger part of the output, or 18,928 tons, was treated at a concentration mill, yielding a lead and a zinc concentrate. No shipments of gold and silver bullion were made in 1909. The most important producer was the Tombstone mine. Ore was produced mainly from the 700-foot and 800-foot levels and was treated in the concentration mill, but a small part of that mined was shipped directly to the smelter. Since the company commenced operations in 1903 the mines are reported to have produced 9,353,068 pounds of lead, 37,013 ounces of gold, 2,517,845 ounces of silver, and a small quantity of copper. In June an accident caused the stoppage of the pumps on the 1,000-foot level of the pump shaft of the Tombstone property and the mines were speedily flooded to the 800-foot level. A new set of pumps, equal in capacity to those drowned, was set up on the 800-foot level, and when the 1,000-foot level is unwatered and the pumps recovered the maximum total pump capacity will be about 12,000,000 gallons daily. The Herschell and Bunker Hill mines recorded important shipments of lead ore, containing gold and silver.

Turquoise district.—Operators of 7 properties reported the production of 66,871 tons of ore, containing $69,778 in gold, 279,642 fine ounces of silver, and 1,206,312 pounds of copper, with a total value of $372,013. About half of the tonnage was shipped directly to smelters, and the remainder was milled at the cyanide plant of the Commonwealth mine and yielded bullion containing 2,716.43 ounces of gold and 228,471 ounces of silver, valued at $174,327.[a] The smelting ores shipped from the district, aggregating 32,047 tons, contained 659.08 ounces of gold, 51,171 ounces of silver, and 1,206,312 pounds of copper, a total value of $197,053, and an average value of $6.15 per ton. Besides the Commonwealth mine, the most active properties developing and shipping were the Courtland mines of the Calumet & Arizona Mining Cmpany, and the Copper Belle, Gleeson, Frone, and Tom Scott mines. The Mary mine of the Great Western Company supplied ore to the smelter at El Paso, Tex. Most of the ore shipments were from the Copper Belle mine, yielding principally a low-grade sulphide, which is used as flux at the Shannon smelter near Clifton, in Graham County. The ores hoisted from the Germania shaft of the Calumet and Arizona Company were shipped to the company furnaces at Douglas. The shaft was sunk 201 feet during 1909 to the 500-foot level. Other development work consisted of sinking the April Fool shaft to the 500-foot level. Work on the bottom level of both shafts was done with a view of finding downward extensions of the ore bodies, but so far this has not been successful. Stoping is confined to the 261-foot level. The Copper Queen Consolidated Mining Company did considerable work on ground under option adjoining the Mary and Germania properties, and, according to its printed annual statement, the results of work performed were discouraging. In November a new discovery of gold-bearing quartz was made in another part of the district at the Gold Queen mine.

Warren district.—The output of 1909 was reported by 6 companies operating deep mines in Warren district, which yielded 1,124,576 tons of copper ore, containing $376,912 in gold, 963,226 ounces of silver, 139,336,773 pounds of copper, and 437,601 pounds of lead, having a total value of $19,010,387 and an average value of $16.90 per ton. All this ore was of shipping grade and was treated at the copper furnaces of the Copper Queen or Calumet and Arizona Mining companies, at Douglas. The lead ore was shipped to El Paso, Tex. The Copper Queen mine was the largest producer, yielding 595,623 tons of ore containing 84,429,791 pounds of copper, 8,644.14 ounces of gold, and 592,928 ounces of silver. Lessees mined and shipped 538 tons of lead ore containing 437,601 pounds of lead, 8,881 ounces of silver, and 30.14 ounces of gold.[a] The production of the Copper Queen is the largest recorded by any single company in Arizona. New ore-bearing territories were discovered in the Copper Queen mine[b] in 1909. These were partly developed at several points, notably in the Uncle Sam country, on the limestone contact with the western boundaries of the Sacramento Hill porphyry, and in the lower levels of the Lowell mine. As the ore occurs in irregular deposits in limestone, the square-set system of mining is adopted. A marked economy is reported as the result of the introduction in 1909 of electric haulage for transportation of ore underground. Formerly the ore was trammed by men and mules to 5 shafts. Now electric trolley lines on 7 levels, to which the ore from each intermediate level is dropped through main chutes, carry the ore to the Sacramento shaft, through which it is hoisted to the surface and automatically transferred by belt and tipple to train of railroad cars. At the Calumet and Arizona[c] property the Powell shaft was started the latter part of 1908 to develop the Hope and Wagner claims. The shaft was sunk to a depth of 647 feet and drifting was done on the 3 lower levels, but no ore of consequence was found and work was temporarily discontinued in December. Development during 1909 consisted of a total of 27,562 feet through the Oliver, Irish Mag, and Powell shafts. The Oliver shaft was extended in 1909 and is now 1,375 feet deep and opens the 1,450-foot level. The largest sulphide ore body so far found is in the Buckeye claim and is reached from the Oliver shaft. Development shows this ore to extend in places from the 1,150 to the 1,250 foot level, and with improved values is larger on the 1,350-foot level. The production of ore of smelting grade from the property was 290,360 dry tons, with an average recovery of 4.709 per cent of copper. The refined copper recovered amounted to 27,630,010 pounds. The product of gold and silver was valued at $211,760, averaging $15.32 per ton of refined copper. The smelting works at Douglas now treat 2,400 tons of charge per day when the 6 copper furnaces are in operation. Development work through the Cole, Junction, and Hoatson shafts of the Superior and Pittsburg Copper Company aggregated 26,070 feet in 1909. None of the shafts were deepened. Production consisted of 222,416 tons of dry ore smelted, with an average recovery of 5.49 per cent of copper, or a total of 24,440,404 pounds of fine copper. High-grade sulphide copper ore was mined on the 1,500-foot level and is a continuation of the ore body found on the 1,200-foot, 1,300-foot, and 1,400-foot levels. The next largest shippers of the district were the Calumet and Arizona and the Superior and Pittsburg properties, yielding a combined output of 52,188,263 pounds of copper,

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[a] Statement of gross product for the year 1909, published by the auditor of the Territory, 1910.

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[a] Statement of gross product for the year 1909, published by the auditor of the Territory, 1910.
[b] Annual report Phelps, Dodge & Co., 1909.
[c] Annual report Calumet and Arizona Mining Company, 1909.

9,517.25 ounces of gold, 360,411 ounces of silver, aggregating in value $7,157,423.[a] Other mines producing were the Denn, the Shattuck, and the Wolverine-Arizona. At the Shattuck mine ore bodies have been found which are reported to be of similar grade to those of the older properties. Promising ore bodies have been reported uncovered in the Denn-Arizona, east of the proved ground, and along and near the line of truncation of the ore-bearing trough by the Dividend fault. Work on the Wolverine-Arizona has opened a new ore body and the mine is producing shipments of 150 tons of ore weekly. About 9 miles west of Bisbee, in what was hitherto regarded as outside the mineral zone, the Empire State Mining Company has opened a low-grade copper ore deposit. This has caused the commencement of a considerable amount of work on other properties in that region.

Winchester district.—The Hearst properties were extensively examined in 1909 by the Copper Queen Consolidated Mining Company, looking for large bodies of siliceous gold ores for converter lining.

COCONINO COUNTY.

One operator in Coconino County reported production of ore in 1909. This ore contained silver and copper and was shipped to the smelter from the Francis district. The price of copper and the closing of the Humboldt smelter, near Prescott, have retarded the production of low-grade copper ores. It is expected that the Anita mines, previously worked by the Consolidated Arizona interests, will be productive again in 1910.

GILA COUNTY.

Operators of 22 properties in Gila County in 1909, against 24 in 1908, reported a production of 445,688 tons of ore, an increase of 3,258 tons. The production was $25,408 in gold, 155,493 fine ounces of silver, 39,451,896 pounds of copper, and 13,442 pounds of lead, with a total value of $5,235,520. The total average value per ton increased from $11.48 in 1908 to $11.75 in 1909. The gold and silver value decreased from 32 cents per ton in 1908 to 24 cents in 1909. Of the output, 187,090 tons were treated at smelters and contained 951.76 ounces of gold, 121,524 ounces of silver, 33,469,795 pounds of copper, and 13,442 pounds of lead, which yielded a total value of $4,434,519, or an average value of $23.70 per ton. The remainder of the total tonnage of ore mined, or 123,976 tons, was treated at concentration mills and contained gold, silver, and copper. These ores yielded 40,399 tons of concentrates, containing 225.59 ounces of gold, 30,893 ounces of silver, and 5,982,101 pounds of copper, which aggregated $798,400 in value, or an average value of $19.76 per ton. At one amalgamation mill ore was treated which yielded gold and silver bullion, making up the remainder of the output of the county. A large part of the crude ore produced was treated at the Old Dominion smelter at Globe and a small part of it was shipped to outside plants. A large tonnage of old slag was smelted, the metallic contents of which are included in the totals.

Globe district.—As the mining territory of this district represents a large part of Gila County, the production of its mines is practically represented by the county totals. In 1909 the largest producers of copper ore were the Old Dominion, United Globe, Warrior, Copper Hill, Superior and Boston, Gem, and Summit mines. Others shipping ore were the operators of the Copper and Silver Zone, Duquesne, El Capitan, Rambo, and Union properties. Numerous small shipments were made by lessees working on various properties. Work on the Arizona-Colorado mine, 3 miles north of Globe, had recently exposed copper ore containing chalcopyrite and bornite on the 800-foot level in a drift 105 feet south of the shaft. At the Superior and Boston, the McGaw shaft was 635 feet deep and sinking was being continued to the 800-foot level. The Cactus mine was expected to produce in 1910. Near the Old Dominion and United Globe mines the Arizona Commercial mine yielded ore, which received treatment at its matting furnace, which was producing about 18 tons of 50 per cent copper matte per day. The most prominent of the new properties developing was the Miami. It is situated 6 miles west of Globe, and to this point the Gila Valley and Northern Globe Railroad has been extended during 1909. The property is opened by four shafts; its deepest one, the main working shaft, is 720 feet deep, but for the purpose of economical mining a new 4-compartment hoisting shaft has been sunk. The Miami company reported 15,000,000 tons of developed ore, averaging about 2.75 per cent of copper. A concentration mill capable of treating 2,000 tons of ore per day was being built. In the Inspiration, Live Oak, Cordova, Warrior, and other properties in close proximity to the Miami, there have also been opened large bodies of disseminated chalcocite deposits in schists.

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[a] Statement of gross product for the year 1909, published by the auditor of the Territory, 1910.

Lost Gulch district.—The Bonanza group, operated by the Lost Gulch United Mines Company, produced ore which was treated in its stamp mill. Part of this production, which was shipped to the smelter, contained lead and copper, and was produced from the Cedar Tree claim.

Payson district.—This district is 41 miles north of Roosevelt and about 100 miles north of Globe. Since the 1st of December the Tonto River Copper Company has opened two veins containing copper, and operators of the Crescent gold mine have developed gold ore. The Payson Gold Mining Company completed the erection of a 15-ton mill at the Standard mine and was treating gold ore.

San Carlos district.—The copper matting furnace at Christmas, the property of the Saddle Mountain Mining Company, was idle. It is reported that the property has been transferred to the Development Company of America.

GRAHAM COUNTY.

Mine production of gold, silver, and associated metals in Graham County, Ariz., in 1908 and 1909.

Metal.	1908		1909		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold ....fine ounces..	1,388.51	$28,703	1,871.24	$38,682	+ 482.73	+ $9,979
Silver ....do....	124,531	66,001	88,082	45,803	− 36,449	− 20,198
Copper ....pounds..	77,149,079	10,183,678	71,826,650	9,337,465	−5,322,429	−846,213
Lead ....do....	30,255	1,271	44,729	1,923	+ 14,474	+ 652
Total..................	....	10,279,653	....	9,423,873	....	−855,780

Although the record for Graham County shows its tonnage of ore mined to have increased 58,702 tons in 1909 as compared with the production of 1908, the yield of silver and copper decreased. The ore mined in 1909 aggregated 1,566,989 tons, produced from 23 deep mines, or 6 less than in 1908. The total average value per ton decreased from $6.81 in 1908 to $6.01 in 1909. Of the total ore produced, 1,084 tons, containing small quantities of gold and silver but no copper, were shipped to the smelters for use as converter lining. An important tonnage of siliceous copper ore, exceeding an average of 2.5 per cent of copper, is mined at Morenci and Metcalf and used as converter lining by the smelters. Sixty-nine tons, classed as lead ore, were shipped to plants outside of Arizona. The greater part of the ore mined, 1,303,963 tons in quantity, was treated at concentration mills in the county and yielded 200,231 tons of concentrate, containing 138 ounces of gold, 5,125 ounces of silver, and 52,852,454 pounds of copper, aggregating in value $6,876,337, or an average of $34.34 per ton. Ore mined and shipped directly to the smelter, nearly all of which, except the lead ore, was treated in the county, amounted to 262,848 tons, containing 1,623.65 ounces of gold, 82,939 ounces of silver, 18,974,196 pounds of copper, and 44,729 pounds of lead, aggregating in value $2,545,262, or an average of $9.68 per ton. The gold from placers decreased from a total value of $662 in 1908 to $311 in 1909. The principal copper producer was the Arizona Copper Company, and the next in importance were the Detroit and Shannon Copper companies.

Aravaipa district.—A small quantity of lead ore, containing gold, silver, and copper, was produced from the Sinfane claims in 1909 and shipped to a lead smelter outside of Arizona.

Ash Peak district.—Two operators in this district shipped 367 tons of gold-silver ore, part of which contained a small quantity of copper. The ore was valuable as converter lining at the smelter and contained $421 in gold, 4,713 ounces of silver, and 473 pounds of copper, aggregating in value $2,934, or an average of $7.99 per ton.

Clark district.—The Mascot Mining Company, shipping a trial lot of copper ore containing high values in gold, was the only producer in 1909.

Copper Mountain and Greenlee districts.—A large tonnage of siliceous copper ore, used for converter lining at the Clifton and Douglas smelters, was mined at Metcalf and Morenci in 1909. Some of the ore was mined by lessees from surface workings. The principal copper-ore producers were the Arizona, Detroit, and Shannon mines. Other properties producing were the Standard mines, the Clifton Copper mine, and the New England mines. The Gold Belt property is equipped with a new 5-stamp amalgamation mill, which was operated in 1909 by lessees who shipped a small quantity of gold bullion in December. A newly discovered ore body in a practically undeveloped field was opened in 1909 on the Simpson group of the Arizona Copper Company. The property is situated in Gold Gulch, near Morenci, and has been worked by Mexican lessees for some time. In the Arizona Copper Company mines large ore reserves were reported as blocked out, and the Coronado mine alone was said to show an ore body 55 feet in width, in which a drift had been extended at the 700-foot level for a length of 630 feet. At the Shannon mine production was greatly increased, developments in ground previously considered nonmineral were reported to have opened below the ore tunnel for 80 feet, a body of sulphide ore averaging 8 per cent of copper, also a streak of ore 8 feet in width assaying as high as 35 per cent of copper; and in a winze below the ore tunnel 20 feet of ore was opened, assaying, it was said, 15 per cent of copper.

Gold Hill district.—The Gold King mine, north of Morenci, otherwise known as the Crawford property, produced gold bullion in 1909 from the operation of its 10-ton cyanide plant.

Lone Star district.—No production was recorded in 1909 from this district, for which Safford is the post office. Active development work, however, was carried on in several properties.

MARICOPA COUNTY.

During 1909 the Relief mine, near Phoenix, was idle. The principal properties producing and developing were the Fort Worth group, in the Cave Creek district, and the Vulture mine, in the Vulture district.

Cave Creek district.—Two operators of deep mines reported gold bullion shipments as the result of milling operations. The total output was valued at $3,011.

San Domingo district.—The principal part of the output was places gold reported by merchants who purchased it from small operatorr in San Domingo Gulch. One test lot of gold ore was shipped from the district. Considerable development work was reported by several companies.

Vulture district.—In 1909 the Vulture mine and mill were operated and important shipments of gold bullion were made, beginning in April. The output consisted of 1,032.97 ounces of gold and 250 ounces of silver, valued at $21,480.[a] A body of gold ore, from 8 to 16 feet in width, has been opened below the old workings. This ore, in three months' operation of the old 20-stamp mill, averaged from $11 to $18 per ton in gold, of which 80 per cent of the values is recovered by amalgamation. The property is now being equipped with a new 200-ton Nissen mill. Ample water to run the mill has been developed in the mine.

MOHAVE COUNTY.

Twenty-nine operators produced in 1909 ore amounting to 30,822 tons, a decrease of 45,886 tons from the output of 1908 and a decrease of 13 in the number of operators. The production was $356,363 in gold, 79,662 fine ounces of silver, 313,384 pounds of copper, 113,406 pounds of lead, and 5,264,121 pounds of zinc, with a total value of $727,666. The total average value per ton increased from $5.17 in 1908 to $23.56 in 1909, and the gold and silver contained in the ore increased from $4.13 in 1908 to $12.86 in 1909. The large differences in tonnage and average values are accounted for by the idleness of the Gold Road mine, which, in 1908, was the principal producer of gold and silver ores and mined a larger tonnage than any other mine in the county. Of the total tonnage, 23,466 tons consisted of siliceous ores, 6,696 tons of zinc ore, 502 tons of copper ore, and 158 tons of lead ore. The greater part of this tonnage, or 23,298 tons, was treated at mills using principally the cyanide process and yielded 15,153.09 ounces of gold and 7,820 ounces of silver, valued at $317,308, an average of $13.62 per ton. In addition to the bullion produced at one of the mills, 15 tons of concentrate yielded 42.20 ounces of gold, 151 ounces of silver, 135 pounds of copper, and 387 pounds of lead, the total being valued at $986, an average value of $65.73 per ton. Crude ore shipped to smelters aggregated 7,524 tons and yielded 1,977.25 ounces of gold, 71,680 ounces of silver, 313,249 pounds of copper, 113,019 pounds of lead, and 5,264,121 pounds of zinc, valued at $407,992, an average value of $54.22 per ton. The zinc contained in crude ore is reported as spelter, as in this form the product was obtained by the distillation furnaces in Oklahoma, where the ore was shipped in 1909. The other ores, which were chiefly lead, were largely treated at the lead smelter at Needles, Cal.

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[a] Statement of gross product for the year 1909, published by the auditor of the Territory, 1910.

Bentley district.—The Grand Gulch mine was the only producer in the district in 1909. Total shipments of copper ore to the smelter contained 299,154 pounds of copper and 1,720 ounces of silver.[a] The output was shipped by way of Moapa, Nev., to the Salt Lake smelters.

Chemehuevis district.—A shipment of ore containing gold, silver, and lead was made from the Monarch property in 1909. Considerable development work was carried on in the Chemehuevis Mountains by several companies in 1909, and it was expected that considerable gold ore would be shipped during 1910. The placer ground in the district has attracted some attention. The ground has been tested and an important lot of bullion was shipped in 1909.

Gold Basin district.—At the Cyclopic mine much development work was in progress, and the gold bullion produced was increased over the output of the year before.

Music Mountain district.—North of Hackberry, in the Music Mountains, the Nevada-Arizona Mines Company is developing high-grade milling ore, and is now erecting a 10-stamp mill.

San Francisco district.—Three operators reported the treatment of 18,106 tons of ore, containing $300,036 in gold, and 7,118 ounces of silver, having a total value of $303,737, an average value of $16.77 per ton. The two principal producers were the Gold Road and the Tom Reed properties. The Tom Reed mine is about 1½ miles south of the Gold Road mine and is in the same formation and has similar ore. A 250-foot shaft and about 1,800 feet of drifts and crosscuts have proved the existence of a large body of gold ore in the Tom Reed mine.

Wallapai district and Union Pass camp.—The total output reported from 18 deep mines aggregated 11,658 tons, containing $48,595 in gold, 69,966 ounces of silver, 1,774 pounds of copper, 113,112 pounds of lead, and 5,264,121 pounds of zinc, the total valued at $374,335, or an average of $32.11 per ton. Two-thirds of the tonnage was shipped directly to smelters, and the remainder, 4,638 tons, was treated at mills equipped with amalgamation and concentration processes. The ore treated yielded bullion containing 336.51 ounces of gold, 33 ounces of silver, and 10 tons of concentrate, containing 39 ounces of gold, 147 ounces of silver, and 387 pounds of lead. The Redemption Copper Company erected a concentrator, which it expects to operate on low-grade ores. The Golconda was the principal mine producing the bulk of the shipping ore, which contained zinc. Its production is included in this district, as it represents only one producer in the Union Pass camp.

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[a] Statement of gross product for the year 1909, published by the auditor of the Territory, 1910.

Weaver district.—The only producer in 1909 was the property of the Utah-Arizona Company, which yielded some gold, silver, and copper from bullion and concentrate during a test run of the mill on the property. From the Dandy mine some specimens of free gold quartz are reported to have been sold to jewelers. In the Virginia camp the Dixie Queen Mining Company was erecting a 5-stamp mill.

PIMA COUNTY.

The ore produced by 29 operators in Pima County in 1909 aggregated 298,623 tons, an increase of 165,966 tons over the 1908 production. The metal production was $7,789 in gold, 199,787 fine ounces of silver, 13,400,968 pounds of copper, and 406,949 pounds of lead, with a total value of $1,871,303. The total average value per ton for the ore in 1908 was $8.80. It decreased in 1909 to $6.26, the larger portion of which was for copper and lead, leaving only 37 cents in gold and silver. The output consisted of 296,701 tons of copper ore, 1,460 tons of lead ore, 440 tons of copper-lead ore, and 22 tons of siliceous ore. The larger part, consisting of 287,828 tons of copper and lead ore, was shipped directly to smelters, and contained 103.34 ounces of gold, 198,523 ounces of silver, 13,060,941 pounds of copper, and 406,949 pounds of lead, aggregating in value $1,820,790, an average value of $6.32 per ton. Ores treated at concentration mills aggregated 10,791 tons and yielded 678 tons of concentrate, which contained 165.09 ounces of gold, 1,246 ounces of silver, 340,027 pounds of copper, having a total value of $48,264, an average value of $71.18 per ton. Only 4 tons of ore were treated at an amalgamation mill, yielding a small quantity of gold and silver bullion. The placer output of gold in 1909 was $2,200, against $4,155 in 1908. The larger part of the copper ores was treated at the Southern Arizona smelter, at Sasco. Since December, 1908, two furnaces at Sasco have been operating and have made matte of good converting grade, averaging close to 40 per cent of copper. The cost of mining, transportation of ore from Silver Bell, smelting, and converting has been reduced to an average of $4.91 per ton of ore, and has been as low as $4.55 per ton. The company contemplates the increase of the Sasco smelter from 750 to 1,500 tons daily to treat ores of the Gila Sulphide, London Range, London Arizona, and Ball Copper companies, near Winkelman.

Ajo district.—Four mines in 1909 produced 810 tons of ore, yielding $3,401 in gold, 894 ounces of silver, and 142,516 pounds of copper, having a total value of $22,393, or an average value of $27.64 per ton. The larger part, or 774 tons, was treated at mills in the district and concentrates and precipitates with 36 tons of crude ore were hauled 50 miles to the railroad station at Gila Bend. The principal properties producing were the Cornelia, Ajo, and Growler mines. On the Ajo property a churn drill was operated, and 15 miles south of this the Growler mine was developed by the sinking of the main shaft to the 500-foot level.

Amole district.—From reports of 4 small producers, the shipments of ore aggregated 25 tons, containing gold, silver, and copper.

Arivaca district.—Only 1 operator reported production in 1909, against 3 producers in 1908.

Coyote district.—Coyote district is 42 miles south of Tucson. Only the richest ores can be shipped. The Bonanza group was operated in 1909 and a trial lot of copper ore was shipped to the smelter at Sasco.

Empire district.—Lead and copper ore, containing some silver, was shipped from the Empire district by 1 operator in 1909.

Greaterville district.—Transient miners working in the Greaterville district during 1909 are reported to have produced placer gold valued at $2,209, as against a production of $3,109 reported in 1908. Hydraulic machinery is said to have been introduced on one of the placer properties, but no production of gold from that method of mining was reported.

Helena district.—The Arizona Camp Bird Mine Company reported the development of the Rosemont group of claims and the remodeling of the concentration mill on the property. The company expected to produce in 1910.

Helvetia district.—The total output of the Helvetia district amounted to 11,287 tons of ore shipped to smelters, which yielded $597 in gold, 11,698 ounces of silver, and 1,156,604 pounds of copper, aggregating in value $157,038, or an average value of $13.91 per ton. Two operators reported production, the largest producer being the Helvetia Copper Company. A large amount of development work was performed on this property during 1909. A large tonnage of self-fluxing smelting ore, assaying from 2.5 per cent to 5 per cent of copper, was developed, and a diamond drill was operated from the lower levels of the mine to locate the continuation of the ore body at depth. Work was retarded by a heavy flow of water in the lower levels, which has now been overcome.

Pima district.—Eight operators, in 1909, reported mining and shipping 14,672 tons of ore to smelters yielding $786 in gold, 53,493 ounces of silver, 1,696,166 pounds of copper, and 282,150 pounds of lead, having a total value of $261,236, or an average of $17.80 per ton. The largest producer was the Twin Buttes mine, from which was shipped a copper-gold ore. Ore was also shipped from the Esperanza and the Victoria mines, formerly known as the Paymaster, and the Rich Hill properties.

Quijotoa district.—The Wayne Development Company, operating the Rochester mine and the concentrator erected at Weldon, shipped a product to the smelter containing lead, copper, and silver. The total output of the district amounted to a value of only $214 in 1909, as against an output of $4,141 in 1908.

Silverbell district.—A tonnage of ore aggregating 270,833 tons was mined from 5 properties in 1909, as against 120,165 tons mined from 4 properties in 1908. The yield from ores treated in 1909 was $496 in gold, 124,823 ounces of silver, 10,385,889 pounds of copper, and 10,743 pounds of lead, aggregating a total value of $1,416,032 and an average value of $5.23 per ton. Nearly all of the crude ore mined was smelted at Sasco, with the exception of 10,009 tons, which were concentrated and treated also at Sasco, yielding 539 tons of concentrate containing 219,104 pounds of copper and 181 ounces of silver. The principal property producing was the Imperial, which since 1904 has yielded 34,569,439 pounds of copper and 289,392 ounces of silver. Other properties producing shipping ore were the El Tiro and the Oxide mines. Some old waste dumps were sorted over and shipments made by lessees. All the larger companies of the district have been prospecting with churn drills the disseminated copper deposits in monzonite porphyry. Results have apparently been encouraging.

PINAL COUNTY.

In 1909 a production of 36,644 tons of crude ore was reported from Pinal County by 15 operators. This was 32,748 tons greater than the production of 1908, which was reported by 22 operators. The metal production was $53,405 in gold, 18,406 fine ounces of silver, 673,760 pounds of copper, and 9,850 pounds of lead, with a total value of $150,989. The total average value per ton in 1909 was $4.12, as against $7.98 in 1908. The gold and silver value of this ore per ton was $1.72 in 1909, against $4.33 in 1908. Of the tonnage produced, the larger part, aggregating 25,849 tons, was concentrated, and yielded 1,385 tons of concentrate containing 5.11 ounces of gold, 2,939 ounces of silver, 637,310 pounds of copper, and 3,304 pounds of lead, having a total value of $84,626 and an average value of $61.10 per ton. The next largest tonnage was treated at amalgamation mills and aggregated 10,594 tons, yielding bullion containing 2,558.46 ounces of gold and 947 ounces of silver. No placer production was reported in 1909.

Bunker Hill district.—The American Eagle mine, operated by the Copper Creek Mining Company, was the only producer in 1909. Shipments of crude smelting ore, containing copper, gold, and silver, were made to the smelters.

Casa Grande district.—Three operators reported the concentration of 400 tons of ore, yielding 11 tons of concentrate, which, with 49 tons of crude ore, was shipped to the smelters in 1909. The total yield of gold, silver, copper, and lead was valued at $5,316, as against a production in 1908 valued at $7,551. The principal mine producing was the Vekol property, 40 miles northeast of Casa Grande. Smaller shipments were made from the Copperosity and the Jack Rabbit properties.

Mineral Creek district.—A large tonnage of ore was tested in 1909 by the Ray Consolidated Copper Company, preparatory to the erection of a large concentration plant. The tests resulted in a production of 605,108 pounds of copper and 324 ounces of silver, having a total value of $78,722.[a] The Ray mine has been more or less actively worked for the last 24 years, but it is to the credit of the last organization that an entirely new class of copper-ore deposit was opened, namely, disseminated chalcocite deposits in schists, of which 42,000,000 tons have been developed by shafts and churn drills. Other properties, the Ray Central, the Hercules, and the Gila, in the same district, are reported to have developed at the end of 1909 over 23,000,000 tons. The Ray Consolidated Company is building a railroad from the Southern Pacific to its mill site near Winkelman, where a concentrating mill, having a daily capacity of 8,000 tons, and a smelter will be erected, and work has already been started upon the foundations.

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[a] Statement of gross product for the year 1909, published by the auditor of the Territory, 1910.

Old Hat district.—In 1909 operators of 3 deep mines reported a production of 10,521 tons of ore, yielding $52,793 in gold, 385 ounces of silver, 54 pounds of copper, and 68 pounds of lead, having a total value of $53,003, and an average value of $5.04 per ton. All of the ore was treated in an amalgamation mill. The Mohawk mine was the principal producer, and yielded all of the ores containing gold and silver.

Pioneer district.—The production of the district aggregated 191 tons of ore, the larger part of which was treated at an amalgamation and concentration mill. The yield of the district's ores, including gold, silver, copper, and lead, had a total value in 1909 of $1,610, as against $1,848 in 1908. The principal production was reported from the Superstition and the White Elephant groups.

Silver King district.—A silver ore containing some copper and gold was shipped from the Silver King group in 1909. Originally the Silver King mine produced a large tonnage of high-grade silver ore, and the present operators believe it will develop at depth into a copper mine.

SANTA CRUZ COUNTY.

The quantity of ore mined in Santa Cruz County increased from 952 tons in 1908 to 1,957 tons in 1909; the number of operators decreased from 20 in 1908 to 10 in 1909; the total value of the ore produced decreased from $25.41 in 1908 to $13.27 in 1909; and the gold and silver values per ton decreased from $10.11 in 1908 to $3.31 in 1909. The metal production was $2,033 in gold, 8,710 fine ounces of silver, 148,869 pounds of copper, and 3,460 pounds of lead, with a total value of $26,064. The largest part of the production, or 1,810 tons, was shipped directly to smelters and yielded 20.27 ounces of gold, 7,437 ounces of silver, 148,201 pounds of copper, and 3,130 pounds of lead, with a total value of $23,687 and an average value of $13.09 per ton. Ore treated at amalgamation mills yielded, from 147 tons of ore, bullion containing 55.67 ounces of gold, 134 ounces of silver, and 8 tons of concentrate, containing 18 ounces of gold, 1,138 ounces of silver, 668 pounds of copper, and 330 pounds of lead. The placer yield in 1909 was $92 in gold and silver, as against $299 in 1909. Most of the ore mined was siliceous in character.

Harshaw district.—The output of the Harshaw district, reported by two operators in 1909, was valued at $1,002, as against a production in 1908 of $7,147. The output for both years contained gold, silver, copper, and lead. The principal producer in 1909 was the Sunnyside and Volcano group.

Nogales district.—The Vera No. 1 claim was a producer in 1909 of ore taken out during assessment work. It produced siliceous ore and lead ore, both containing fair quantities of gold and silver.

Oro Blanco district.—The total production of ore, from 2 properties, in 1909 was treated in mills equipped for amalgamation and concentration. The quantity of ore treated was 147 tons, yielding bullion containing $1,151 in gold, 134 ounces of silver, and 8 tons of concentrate, containing $372 in gold, 1,138 ounces of silver, 668 pounds of copper, and 330 pounds of lead.

Patagonia district.—The Erin mine and the Mumme mine were the principal producers, yielding 96 tons of ore containing gold, silver, and copper valued at $2,559, against a production in 1908 valued at $4,787, and containing lead in addition to the other metals. The concentrator and furnaces of the Duquesne Mining and Reduction Company were idle, as was also the lead smelter of the Santa Cruz Company at Mowry. The World's Fair and other mining property in the region south of Patagonia remained idle in 1909.

Tyndall district.—Only one operator reported production in 1909 which represented but 2 tons of ore containing silver and copper shipped to smelters.

Wrightson district.—Two properties in this district were operated in 1909, as against 6 in 1908. The output, however, was greater, as a larger tonnage of ore containing principally copper and silver was shipped to the smelters. Large shipments of low-grade pyritic copper ore were made from the Augusta mine to the smelter at Globe. Advantage was taken of the low freight rate on ores averaging less than 10 per cent of copper. Some of the shipments of ore assayed less than 6 per cent of copper.

YAVAPAI COUNTY.

Mine production of gold, silver, and associated metals in Yavapai County, Ariz., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold............fine ounces..	54,024.86	$1,116,793	46,064.76	$952,243	−7,960.10	−$164,550
Silver...................do....	602,645	319,402	578,580	300,862	− 24,065	− 18,540
Copper..............pounds	36,248,440	4,784,794	37,125,964	4,826,375	+ 877,524	+ 41,581
Lead..................do....	362,334	15,218	409,890	17,625	+ 47,556	+ 2,407
Total..............	....	6,236,207	....	6,097,105	....	− 139,102

Eighteen mining districts in Yavapai County with 48 deep mines produced in 1909. Included in the output is the gold reported as produced from 8 different placer diggings. The ore mined aggregated 323,489 tons in 1909, as against 314,113 tons in 1908. The total average value per ton decreased from $19.81 in 1908 to $18.80 in 1909. The decrease in the total value is largely accounted for by the decrease in the average value of the gold and silver content, which in 1908 was $4.53 and in 1909 was only $3.83. Nearly all of the ore was of smelting grade and this aggregated 275,918 tons, containing 25,399.23 ounces of gold, 536,069 ounces of silver, 37,085,765 pounds of copper, and 23,256 pounds of lead, with a total value of $5,625,954, and an average value of $20.39 per ton. The ore containing lead was shipped to Needles, Cal., and El Paso, Tex., smelters, and a large part of the remainder, containing copper, was treated at the United Verde smelter, at Jerome, and some of it was stored in the yards of the smelter at Humboldt. At amalgamation and cyanide mills 45,309 tons of ore were treated, yielding gold bullion and precipitates containing 9,414.72 ounces of gold and 7,216 ounces of silver. Nearly all of the milling plants are equipped with concentrators and, in addition to the bullion caught on amalgamation plates, concentrates were shipped, of which there were produced in 1909 4,084 tons, yielding 10,498.19 ounces of gold, 35,215 ounces of silver, 40,199 pounds of copper, and 386,634 pounds of lead, with a total value of $257,179, and an average value of $62.97 per ton. The largest producers in 1909 were the United Verde, Poland, Tiger, Gladstone-McCabe, Congress, and Monica mines. New mills were erected at the Etta, Sunnyside, and Mammoth mines, and at the Arizona Copper-Gold Mining Company's mine, in Cherry Creek district. Placers on Rich Hill, in the southern part of the county, and in the Big Bug district, near Prescott, continue to yield important quantities of gold, which, with the small quantity of associated silver, amounted to $15,599 in 1909, as against a yield of $13,708 in 1908. A small part of the placer production for both years was from trial operations of a dredge on Lynx Creek, in the Big Bug district. It is expected that other dredges will be installed in the county during 1910.

Some importance is attached to the fact that the Arizona Power Company utilized the waters of Fossil Creek, in the eastern part of the county, for the production of electric power. Wires were strung through mining districts as far as Prescott. The smelter of the Consolidated Arizona Smelting Company, at Humboldt, has been overhauled and was expected to begin operating the early part of 1910. Ore has been accumulated from the Blue Bell and several other properties, and, with that already stocked in the yards when the smelter closed in 1907, an initial capacity of 450 tons a day is assured. The preparations made by the smelting company for resumption have caused a large number of properties which have lain dormant for the last two years to be put in shape for production during 1910.

Agua Fria district.—There was no production from this district during 1909. Several companies were actively developing mining property. Among these was the Kay Copper Company, developing a deposit of sulphide copper ore in schist. The sulphides are intercalated with the schist in broad lenses, often of high-grade chalcopyrite.

Big Bug district.—In 1909 the output from mines in this district was 17,888 tons, a substantial increase over the production of 1908, which was 13,429 tons. The metal production was $284,376 in gold, 72,495 fine ounces of silver, 319,816 pounds of copper, and 337,184 pounds of lead, with a total value of $378,148. Over half of the ore produced in 1909 was treated at mills using principally the amalgamation process; about one-third of the ore was shipped directly to smelters; and the remainder was treated by concentration. Some of the mills using the amalgamation process, by which the gold and silver bullion was extracted, also produced concentrate. In these mills, 9,493 tons of ore were treated, yielding bullion containing 2,036.92 ounces of gold, 973 ounces of silver, and 2,723 tons of concentrate, containing 4,578.07 ounces of gold, 15,683 ounces of silver, 25,282 pounds of copper, and 266,233 pounds of lead. The total value of the bullion and concentrate was $160,139, and the average value of the ore treated was $16.87 per ton. The Gladstone-McCabe mines were operated by lessees, who were large shippers of concentrate and crude ore.

Black Canyon district.—There was no ore treated at any of the milling plants in this district during 1909, and only one report of production was received giving the figures for the shipment of 26 tons of ore containing lead, gold, and silver.

Black Hills district.—The metal production was $484 in gold, and 685 fine ounces of silver, with small outputs of copper and lead, and a total value of $1,539. Only 42 tons of ore, yielding bullion containing 21.50 ounces of gold and 8 ounces of silver, were treated at an amalgamation mill, and 26 tons of crude ore, which contained 1.91 ounces of gold and 677 ounces of silver, were shipped directly to smelters. The Yaeger Canyon Copper Company, equipped with a small matting furnace, has been idle since 1907.

Black Rock district.—A small production of ore treated at an amalgamation mill and some ore shipped directly to the smelter is the record of this district for 1909. The mines of the district were under development, but the largest producer, the Interior, was closed in 1908 and remained idle in 1909.

Cherry Creek district.—Four deep mines yielded 330 tons of ore treated at amalgamation mills, producing bullion containing 329.41 ounces of gold, 127 ounces of silver, and 29 tons of concentrate, yielding 40.47 ounces of gold and 115 ounces of silver, a total value of $7,772 and an average value of $23.55 per ton. In 1908 the total value of the production was $5,821.

Copper Basin district.—Outside of a small shipment of ore sent directly to the smelter, there was but little development work done.

Eureka district.—Some ore was treated in the concentration mill of the Hillside mine, which yielded gold, silver, and lead. The property of the Big Stick Gold Mining Company and its milling plant, which was erected in 1907, were idle. No production has been reported since the construction of the mill.

Hassayampa district.—Considerable activity was evinced by the production made in 1909 by the mines in this district, which increased its output of ore from 470 tons, valued at $7,470 in 1908, to 3,510 tons, valued at $9,642 in 1909. The metal output was $7,050 in gold, 2,092 fine ounces of silver, 585 pounds of copper, and 33,208 pounds of lead. The largest part of the tonnage was treated at mills equipped with amalgamation and concentration processes, which yielded from 3,475 tons of ore bullion containing 161.20 ounces of gold, 121 ounces of silver, and 62 tons of concentrate, yielding 104.64 ounces of gold, 1,488 ounces of silver, 585 pounds of copper, and 30,718 pounds of lead, the total valued at $7,729 with an average value per ton of $2.22. Crude ore shipped directly to smelters amounted to 35 tons, containing 75.20 ounces of gold, 483 ounces of silver, and 2,490 pounds of lead, with a total value of $1,913 and an average value of $54.66 per ton.

Martinez district.—No crude ore was shipped to smelters from this district in 1909. Practically all of the production was made by the Congress mines, which yielded $180,061 in gold, 16,176 ounces of silver, and 2,979 pounds of copper, valued at $188,763.[a] This value was realized from the gold and silver bullion and concentrate.

Peck district.—A small lot of silver ore was shipped from one mine in the district in 1909.

Tiger district.—One producer in this district, the Tiger mine, yielded in 1909 from ore treated at its mill, which produced gold bullion and concentrate containing $26,182 in gold, 2,726 ounces of silver, and 4,802 pounds of copper, valued in all at $27,738.[a] The total value included the payment by the smelter for iron contained in the concentrate, which was reported as 143,170 pounds.

Turkey Creek district.—Three operators of deep mines and one placer operator reported production in 1909, which yielded $2,310 in gold,

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[a] Statement of gross product for the year 1909, published by the auditor of the Territory, 1910.

1,099 fine ounces of silver, and small amounts of copper and lead, in all valued at $3,136. At milling plants using amalgamation and concentration processes 109 tons of ore were treated, producing bullion containing 44.40 ounces of gold and 8 ounces of silver, and 5 tons of concentrates, which contained 34.55 ounces of gold, 6 ounces of silver, and 520 pounds of copper. Crude ore shipped to the smelters aggregated 25 tons, containing 16.35 ounces of gold, 1,083 ounces of silver, and 4,342 pounds of lead, valued at $1,088, or an average value of $43.52 per ton.

Verde district.—The entire output of the district is represented by the production of the United Verde mine, the only producer in 1909. The metallic output consisted of $351,832 in gold, 495,479 ounces of silver, and 36,695,259 pounds of copper, valued at $5,370,766.[a] In 1908 the total value of the product was $5,460,818. The United Verde Extension property is opened to a depth of 1,060 feet, and in the winze sunk 260 feet from the 800-foot level 130 feet of leached vein material was passed through. Sinking is being continued. Prospecting with a drill on the Arkansas and Arizona property is said to have penetrated copper ore at a depth of 600 feet.

Walker district.—The output of the district was reported by three operators of deep mines and the production of placers from two sources on Lynx Creek. The output of ore amounted to 280 tons. The total metal output from placers and deep mines was $8,366 in gold, 629 ounces of silver, 3,860 pounds of copper, and 14,485 pounds of lead, with a total value of $9,818. The ore had an average value of $26.88 per ton. All of this ore was treated at amalgamation mills equipped for concentration, and both bullion and concentrates were produced.

Weaver district.—The total production of placers and deep mines was $34,112 in gold and nominal amounts of silver and lead, with a total value of $34,438. Through the operation of milling plants most of the ore mined, or 3,205 tons, yielded bullion containing 1,301.88 ounces of gold and 555 ounces of silver. Some concentrates were made containing lead, and a small tonnage of ore containing gold and silver was shipped directly to the smelter. Besides this production the placers at Rich Hill produced in 1909 $6,980 in gold, as against a production in 1908 of $6,089. The principal producer of the district was the Monica mine.

YUMA COUNTY.

In 1909 the production of Yuma County represented a yield by 24 deep-mine operators and a small production of gold by 10 placer operators. The ore mined, 99,804 tons, was an increase of 21,982 tons over the production of 1908, when only 19 deep mines produced. The total yield from placers and deep mines was $779,567 in gold, 17,728 ounces of silver, 144,783 pounds of copper, and 92,339 pounds of lead, having a total value of $811,579. The ores mined had a total average value of $8.05 per ton. This average value was an increase over the average in 1908, which was $4.82, and was almost entirely attributed to the increase in gold and silver contained in the ores mined, which in 1908 was valued at $4.68 per ton and increased to $7.82 per ton in 1909. Nearly all of the ore produced in the county is treated by the cyanide process and but a small part of it by amalgamation. The number of tons of crude ore shipped to smelters increased from 309 tons in 1908 to 1,131 tons in 1909, which yielded 761.72 ounces of gold, 4,523 ounces of silver, 144,783 pounds of copper, 92,339 pounds of lead, valued at $40,891 and an average value of $36.15 per ton. The total value of the shipping ore in 1908 was $19,679 and the average value was $63.68 per ton. The largest shippers of gold bullion in 1909 were the Golden Star Mining Company and the King of Arizona Mining Company. The former produced from its ores $506,233 in gold, 9,937 ounces of silver, having a total value of $511,305,[a] and the latter produced gold valued at $245,017.[a] These two mines are situated in Kofa district. The county output for all metals, particularly that of gold, was increased. The Castle Dome district supplied the lead ore; Ellsworth, Planet, and Plomosa districts, the copper ore; and the Kofa district the increased gold and silver output. A 450-ton copper plant with 2 converter stands was constructed for the Clara mine, at Swansea, 20 miles from Bouse.

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[a] Statement of gross product for the year 1909, published by the auditor of the Territory, 1910.

Castle Dome district.—Three operators reported a production of 75 tons of ore, which, with the placer output, yielded $2,200 in gold, 2,453 ounces of silver, and 92,339 pounds of lead, having a total value of $7,446. The ore was shipped to the El Paso smelter. The production from dry placer diggings aggregated $2,200 in gold and 10 ounces of silver. In Castle Dome Range a large number of promising prospects are said to have been opened in 1909.

Cienega district.—Three operators reported a production of 36 tons of ore, containing $269 in gold, 32 ounces of silver, and 11,233 pounds of copper, with a total value of $1,746, and an average value of $48.50 per ton.

Ellsworth district.—The reports of 4 deep mines gave a production of 598 tons of smelting ore and the treatment of 299 tons of milling ore, producing gold and silver bullion and aggregating a yield of $8,994 in gold, 184 ounces of silver, and 59,099 pounds of copper, a total value of $16,773, and an average value of $18.70 per ton.

Kofa district.—The total output of gold by 2 deep mines and 1 placer operator was $753,084 and 13,105 ounces of silver, having a total value of $759,898. This was extracted from ore treated on each property at milling plants using the cyanide process. The dry placer diggings in this district were operated with good results during 1909. In this region are situated the King of Arizona, North Star, Alvarado, and Amavisca mines. The North Star is located on a wide quartz-porphyry dike, and, in addition to a large body of milling ore, shows a streak of specimen ore worth from $6 to $20 a pound in gold. This dike is an extension of that on which the King of Arizona mine is located. Both the properties are equipped with cyanide mills, which were operated the entire year.

La Posa district.—Two operators reported the production of 23 tons of ore, containing $1,364 in gold, 23 ounces of silver, and 133 pounds of copper, valued in all at $1,393, and an average value of $60.56 per ton. These shipments were made simply as tests shipped from the district by the 2 operators.

Planet and Plomosa districts.—The combined output of these districts reported by 8 deep mines and 2 placer operators aggregated 437 tons of ore, $10,020 in gold, 1,274 ounces of silver, and 73,605 pounds of copper, having a total value of $20,251. All of the ore was of smelting grade, with the exception of 40 tons treated at an amalgamation mill. The Little Butte mine, near Bouse, produced ore yielding $2,233 in gold and 46,170 pounds of copper. The iron contained in the shipments aggregated 179,687 pounds, which was paid for by the smelters, and the total content of the ore was valued at $8,675.[a] In Little Butte mine, at a depth of 365 feet, a body of gold ore with a small percentage of copper has been opened up in sinking the main working shaft. The Signal mines, owned by the Clara Consolidated Co., were under development during 1909 and their copper smelter was being completed. The railroad belonging to the same interests will soon be in operation between Bouse and Swansea, the name of the new town at the mine. The Planet mine, to the north and near the Colorado River, was again opened the latter part of 1909 by a new company. It was being developed on the 600-foot level and also by churn drills from the surface. Other important properties operated were the Goodman and Copper Prince, near Quartzsite, and Heart's Desire, near Bouse. Some activity was reported in the dry placer diggings near Quartzsite.

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[a] Statement of gross product for the year 1909, published by the auditor of the Territory, 1910.

CALIFORNIA.

By Charles G. Yale.

PRODUCTION.

For the calendar year 1909 the California production of gold, silver, copper, and lead was valued at $28,841,050, an increase of $4,035,909 as compared with $24,805,141 in 1908. This increase was mainly due to the augmented output of copper and gold, though silver and lead increased also. The increase in gold was 71,416.54 fine ounces, valued at $1,476,311; in silver, 450,975 fine ounces, valued at $218,035; in copper, 18,511,400 pounds, valued at $2,328,928; and in lead, 265,049 pounds, valued at $12,635. No output of zinc was reported in the State in 1909.

There were 1,127 producing properties, of which 571 were deep mines and 556 were placers. There were 73 more producing mines in 1909 than in 1908. The deep mines may be classified by the relative quantities of metal produced, as follows: Gold, 520; silver and silver-gold, 12; copper, 22; lead, silver-lead, and copper-lead, 17. Of the placer mines 134 are hydraulic, 63 dredge, 118 drift, and 241 surface or sluicing properties. The dredges are considered according to the number of machines at work in 1909, not by number of companies. The drift mines increased in number in 1909, but there were fewer hydraulic, dredge, and surface placers producing than in 1908. There were 76 more deep mines producing in 1909 than in 1908, but there were 3 placers less.

The 571 deep mines producing in the State in 1909 made an output of 3,041,688 tons of ore, 494,780 tons more than was produced in 1908. Of this output 2,195,741 tons were siliceous ore, 840,358 tons were copper ore, and 5,589 tons were lead ore.

The siliceous ore averaged $4.86 per ton in gold and silver, the copper ores $1.78, and the lead ores $7.26. The average in gold and silver from all the ores treated in the State was $4.01 per ton.

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[a] Statement of gross product for the year 1909, published by the auditor of the Territory, 1910.

The 3,041,688 tons of ore of all classes treated in the State in 1909 yielded 538,580.01 fine ounces of gold, valued at $11,133,437; 2,057,286 fine ounces of silver, valued at $1,069,789; 57,288,281 pounds of copper, valued at $7,447,476; and 1,502,597 pounds of lead, valued at $64,612.

The total value of the metals obtained from the ore mined and treated in California in 1909 was $19,715,314, an average value per ton of $6.48. In 1908 the output was 2,546,908 tons, valued at $16,536,226, an average value per ton of $6.49.

In 1909 there were treated at gold and silver mills 2,026,507 tons of ore, and at concentrating mills 27,857 tons, containing altogether $9,833,817 in gold, an average of $4.79 per ton, and silver valued at $189,023, an average value of 9 cents per ton. This was a total value of $10,022,840 in gold and silver and an average value per ton of $4.88 in both metals. This average value per ton was $5.08 in 1908 and $5.71 in 1907.

Of the total value, $7,762,417 in gold, averaging $3.83 per ton, and $137,906 in silver, averaging 7 cents per ton, a total of $7,900,323 in gold and silver, averaging $3.90 per ton in both metals, was recovered as bullion in the mills.

From the 2,026,507 tons of milling ore and the 27,857 tons of ore shipped to concentrating mills, 41,589 tons of concentrates were obtained, valued at $2,071,400 in gold, an average of $49.81 per ton, and at $51,117 in silver, an average of $1.23 per ton. This is a total in gold and silver of $2,122,517, or an average value recovered from the concentrates of $51.04 per ton in gold and silver.

Of smelting ores (mainly copper ores) there were 922,969 tons, valued at $1,113,757 in gold, an average of $1.21 per ton, and at $845,464 in silver, an average of 92 cents per ton. The total yield of gold and silver in the smelting ores was $1,959,221, or an average value of $2.13 per ton in gold and silver.

There were also 64,355 tons of old tailings treated, producing $185,863 in gold, an average of $2.89 per ton, and $35,302 in silver, an average of 55 cents per ton. The total of gold and silver in the tailings was valued at $221,165, an average of $3.44 per ton.

In certain counties, notably Mariposa, Placer, Sierra, and Tuolumne, various "pocket" mines yielded exceptionally high values from small lots of ore, which affect the averages materially. In one case 1 ton of ore yielded $7,000, and in another less than 1 ton yielded $16,000.

The 556 productive placer mines in California in 1909 yielded 440,426.95 fine ounces of gold, valued at $9,104,433, and 40,967 fine ounces of silver, valued at $21,303, a total value in gold and silver of $9,125,736. This was an increase of $856,821 over the palcer output of 1908 in gold and silver. The increase of gold production from placers in 1909 was $873,246, but the value of the reported silver output was less from this source by $16,425. In gold the dredge properties of California showed an increase of $846,761 in 1909, and the drift mines an increase of $349,252, the latter mainly due to an exceptional yield of one mine in Nevada County. The hydraulic mines of the State showed a decrease in gold output of $138,189 in 1909 and the surface placer or sluicing mines a decrease of $184,578.

The statement of production in California for 1908 and 1909, showing increase or decrease and value at each year's commercial prices, is as follows:

Mine production of gold, silver, and associated metals in California in 1908 and 1909.

	1908.		1909.		Increase (+), decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold............fine ounces..	907,590.42	$18,761,559	979,006.96	$20,237,870	+ 71,416.54	+$1,476,311
Silver....................do....	1,647,278	873,057	2,098,253	1,091,092	+ 450,975	+ 218,035
Copper..............pounds..	38,776,881	5,118,548	57,288,281	7,447,476	+18,511,400	+ 2,328,928
Lead....................do....	1,237,548	51,977	1,502,597	64,612	+ 265,049	+ 12,635
Total..................	....	24,805,141	....	28,841,050	....	+ 4,035,909

The following table shows the production of gold, silver, and associated metals in California in 1909, by counties:

Mine production of gold, silver, and associated metals in California in 1909, by counties.

County.	Gold.		Silver.		Copper.		Lead.		Grand total.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
	Fine ozs.		*Fine ozs.*		*Pounds.*		*Pounds.*		
Amador..........	111,203.72	$2,298,785	32,118	$16,701	113,995	$14,819	....	....	$2,330,305
Butte............	144,499.95	2,987,079	13,856	7,205	....	....	....	....	2,994,284
Calaveras..........	69,684.72	1,440,511	137,342	71,418	5,416,315	704,121	....	....	2,216,050
Del Norte..........	77.88	1,610	100	52	62,154	8,080	....	....	9,742
Eldorado..........	11,527.00	238,284	2,498	1,299	....	....	....	....	239,583
Fresno..........	848.45	17,539	16,352	8,503	1,478,623	192,221	....	....	218,263
Humboldt..........	1,242.75	25,690	181	94	3,798	494	....	....	26,278
Imperial..........	2,888.23	59,705	1,007	524	280	36	....	....	60,265
Inyo..............	22,148.30	457,846	90,609	47,117	31,722	4,124	1,490,649	$64,098	573,185
Kern..............	31,675.90	654,799	195,448	101,633	....	....	....	....	756,432
Lassen, Modoc, and Colusa.....	5,627.32	116,327	2,813	1,463	....	....	....	....	117,790
Los Angeles......	41.80	864	4	2	....	....	....	....	866
Madera..........	711.89	14,716	775	403	....	....	....	....	15,119
Mariposa..........	19,178.99	396,465	5,247	2,729	....	....	....	....	399,194
Merced and Stanislaus..........	11,053.30	228,492	1,100	572	....	....	....	....	229,064
Mono..............	17,168.72	354,909	72,677	37,792	3,454	449	582	25	393,175
Monterey..........	16.11	333	10	5	....	....	....	....	338
Nevada..........	128,688.87	2,660,235	47,935	24,926	....	....	....	....	2,685,161
Placer..........	13,611.37	281,372	2,869	1,492	....	....	....	....	282,864
Plumas..........	7,618.63	157,491	1,130	587	....	....	....	....	158,078
Riverside..........	9.00	186	46	24	16,117	2,095	....	....	2,305
Sacramento........	80,777.25	1,669,814	5,492	2,856	....	....	....	....	1,672,670
San Bernardino..	1,938.43	40,071	24,173	12,570	148,312	19,280	11,366	489	72,410
San Diego........	619.78	12,812	3,310	1,721	....	....	....	....	14,533
Shasta............	77,423.66	1,600,489	1,414,346	735,460	50,013,511	6,501,757	....	....	8,837,706
Sierra............	9,175.38	189,672	1,841	957	....	....	....	....	190,629
Siskiyou..........	20,131.74	416,160	4,125	2,145	....	....	....	....	418,305
Trinity............	25,157.22	520,046	4,427	2,302	....	....	....	....	522,348
Tuolumne........	44,780.88	925,703	8,430	4,384	....	....	....	....	930,087
Yuba..............	119,479.72	2,469,865	7,992	4,156	....	....	....	....	2,474,021
Total.......	979,006.96	20,237,870	2,098,253	1,091,092	57,288,281	7,447,476	1,502,597	64,612	28,841,050

GOLD.

The total gold production in California in 1909 was 979,006.96 fine ounces, valued at $20,237,870, as compared with 907,590.42 fine ounces, valued at $18,761,559 in 1908. The increase for 1909 was therefore 71,416.54 fine ounces, valued at $1,476,311. The deep mines of the State yielded 538,580.01 fine ounces of gold, valued at $11,133,437. Of this deep-mine gold, 504,715.72 fine ounces, valued at $10,433,400, was derived from siliceous ores; 33,430.12 fine ounces, valued at $691,062, was from copper ores; and 434.17 fine ounces, valued at $8,975, was from lead ores.

The total placer yield in 1909 was 440,426.95 fine ounces, valued at $9,104,433. Of this, $605,608 was derived from 134 hydraulic mines, $739,797 from 118 drift mines, $7,382,950 from 63 dredges, and $376,078 from 241 surface or sluicing mines. It will be noted that the dredges produced $5,661,467 more gold in 1909 than all the hydraulic, drift, and surface placers combined, or 81 per cent of all the placer gold of the State. The deep mines of California produced $2,029,004 more gold than the combined placers in 1909. The placers produced 45 per cent of the entire gold yield in 1909, and the deep mines 55 per cent.

The dredges in the State produced in 1909 nearly 37 per cent of the total gold yield from all sources. The dredge-mining record in gold for the last eleven years is shown as follows, with the increase or decrease for each year:

Value of gold won by dredging in California, 1899–1909, with increase (+) or decrease (−), by years.

1899	$206,302	
1900	200,929	− $5,373
1901	471,762	+ 270,833
1902	867,665	+ 395,903
1903	1,475,749	+ 608,084
1904	2,187,038	+ 711,289
1905	3,276,141	+1,089,103
1906	5,098,359	+1,822,218
1907	5,065,437	− 32,922
1908	6,536,189	+1,470,752
1909	7,382,950	+ 846,761
Total	32,768,521	

In the three great dredging fields of the State (aside from outside districts, where only one or more machines are in operation), the Yuba County field is increasing its annual output, the Butte County field is decreasing, and the Sacramento County field remains about the same. In Butte County 6 old dredges ceased operations in 1909, having worked out their ground, and but 1 new dredge was constructed. In that field, as in others, work was commenced by each company on the best part of its ground; this, and the fact that some acreages have been entirely worked out, is the cause of falling off in annual yield. In the Marysville or Yuba field additional large dredges have been constructed. In some outlying districts new dredges are being built also, but no new large and extensive dredging fields have been found in the State within the last few years.

Of the 33 counties producing gold in 1909 in California, 9 yielded no placer gold, and 5 yielded no gold from deep mines. Seven counties yielded over $1,000,000 each in gold in 1909, as follows: Butte, $2,987,079; Nevada, $2,660,235; Yuba, $2,469,865; Amador, $2,298,785; Sacramento, $1,669,814; Shasta, $1,600,489; and Calaveras, $1,440,511. Of these, Butte, Sacramento, and Yuba are dredge-mining counties, and the others are essentially deep-mining counties. In gold production from deep mines Nevada County led with an output for the year of $2,265,621, followed by Amador with $2,257,135, Shasta with $1,569,037, and Calaveras with $1,183,462.

The largest production of gold in California in 1909 came from Butte County, as was the case in 1908. The leading hydraulic-mining county, as shown by the returns, was Trinity; the greatest producer from drift mines was Nevada; the largest producer from dredge mines was Butte; and the largest producer of gold from surface or sluicing mines was Siskiyou. The county which showed the largest increase of gold yield in 1909 was Sacramento with an increase of $503,759, followed by Shasta with $468,657, Yuba with $435,379, Amador with $422,611, and Nevada with $362,272. The counties of Sierra, Kern, Butte, San Bernardino, and Eldorado showed material decreases in gold yield for the year.

The production of gold from placers and from different kinds of ore in California in 1909, by counties, in fine ounces, is given in the following table:

Source of gold production in California by kinds of ore in 1909, by counties, in fine ounces.

County.	Placers.	Deep mines.				Grand total.
		Siliceous ore.	Copper ores.	Lead ores.	Total.	
Amador	2,014.82	108,767.51	421.39		109,188.90	111,203.72
Butte	143,301.41	1,198.54			1,198.54	144,499.95
Calaveras	12,434.74	53,137.53	4,112.45		57,249.98	69,684.72
Del Norte	55.34		22.54		22.54	77.88
Eldorado	3,065.48	8,461.52			8,461.52	11,527.00
Fresno	53.99	488.97	305.49		794.46	848.45
Humboldt	1,240.09	2.66			2.66	1,242.75
Imperial	39.33	2,848.90			2,848.90	2,888.23
Inyo	8.47	21,719.64		420.19	22,139.83	22,148.30
Kern	156.88	31,519.02			31,519.02	31,675.90
Lassen, Modoc, and Colusa		5,627.32			5,627.32	5,627.32
Los Angeles		41.80			41.80	41.80
Madera	133.03	578.86			578.86	711.89
Mariposa	277.72	18,901.27			18,901.27	19,178.99
Merced and Stanislaus	11,053.30					11,053.30
Mono		17,168.72			17,168.72	17,168.72
Monterey		16.11			16.11	16.11
Nevada	19,089.45	109,599.42			109,599.42	128,688.87
Placer	9,712.25	3,899.12			3,899.12	13,611.37
Plumas	2,504.08	5,114.55			5,114.55	7,618.63
Riverside			9.00		9.00	9.00
Sacramento	80,777.25					80,777.25
San Bernardino		1,735.69	188.76	13.98	1,938.43	1,938.43
San Diego		619.78			619.78	619.78
Shasta	1,521.49	47,531.68	28,370.49		75,902.17	77,423.66
Sierra	4,998.69	4,176.69			4,176.69	9,175.38
Siskiyou	11,076.62	9,055.12			9,055.12	20,131.74
Trinity	17,814.77	7,342.45			7,342.45	25,157.22
Tuolumne	283.67	44,497.21			44,497.21	44,780.88
Yuba	118,814.08	665.64			665.64	119,479.72
Total	440,426.95	504,715.72	33,430.12	434.17	538,580.01	979,006.96

Comparisons of these totals for 1909 with the gold output of 1908 are as follows:

Mine production of gold in California in 1908 and 1909, by kinds of ore, in fine ounces.

	Placers.	Deep mines.				Grand total.	
		Siliceous ore.	Copper ores.	Lead ores.	Total.	Quantity.	Value.
1908	398,183.67	486,210.01	22,885.83	310.91	509,406.75	907,590.42	$18,761,559
1909	440,426.95	504,715.72	33,430.12	434.17	538,580.01	979,006.96	20,237,870
Increase	42,243.28	18,505.71	10,544.29	123.26	29,173.26	71,416.54	1,476,311

The source of placer gold by counties and from various kinds of mines is shown as follows:

Source of placer gold in California in 1909, by counties.

County.	Hydraulic.	Drift.	Dredging.	Surface placers.	Total.
Amador	$18,503	$8,925		$14,222	$41,650
Butte	15,265	13,597	$2,890,273	43,168	2,962,303
Calaveras	8,836	24,982	211,814	11,417	257,049
Del Norte				1,144	1,144
Eldorado		34,520		28,849	63,369
Fresno				1,116	1,116
Humboldt	25,615			20	25,635
Imperial				813	813
Inyo				175	175
Kern	903			2,340	3,243
Madera				2,750	2,750
Mariposa				5,741	5,741
Merced, Shasta, and Stanislaus			255,585	4,359	259,944
Nevada	11,306	368,476		14,832	394,614
Placer	2,242	135,716		62,812	200,770
Plumas	2,000	9,718		40,046	51,764
Sacramento		115,243	1,534,136	20,435	1,669,814
Sierra	47,538	21,686		34,108	103,332
Siskiyou	113,304	2,234	49,223	64,213	228,974
Trinity	357,672	101		10,491	368,264
Tuolumne	765	4,599		500	5,864
Yuba	1,659		2,441,919	12,527	2,456,105
Total	605,608	739,797	7,382,950	376,078	9,104,433

SILVER.

The yield of silver in California in 1909 was 2,098,253 fine ounces, valued at $1,091,092. As compared with the production of 1908 this was an increase in quantity of 450,975 fine ounces and in value of $218,035. The larger part of the output, 1,539,665 fine ounces, valued at $800,615, was from smelting of copper ores. The siliceous ore, both milled and smelted, yielded 456,826 fine ounces, valued at $237,560, and the lead ores, 60,795 fine ounces, valued at $31,614. The largest quantity from siliceous ores, 195,365 fine ounces, valued at $101,590, came from Kern County. The largest producer of silver was Shasta County, which yielded from copper ores 1,386,817 fine ounces, valued at $721,145, and from siliceous ore 27,279 fine ounces, valued at $14,185; with the output from placer mines included Shasta County produced altogether 1,414,346 fine ounces of silver, valued at $735,460. The silver obtained with the gold in placer mining in the State in 1909 was 40,967 fine ounces, valued at $21,303. The largest producer of placer silver was Butte County, with 13,727 fine ounces, valued at $7,138.

The following table shows the source of the silver output in California in 1909, by placers and kinds of ore, by counties, in fine ounces:

Source of silver product in California by kinds of ore in 1909, by counties, in fine ounces.

County.	Placers.	Deep mines.				Grand total.
		Siliceous ore.	Copper ores.	Lead ores.	Total.	
Amador	385	18,706	13,027		31,733	32,118
Butte	13,727	129			129	13,856
Calaveras	1,279	16,367	119,696		136,063	137,342
Del Norte	6		94		94	100
Eldorado	423	2,075			2,075	2,498
Fresno	21	106	16,225		16,331	16,352
Humboldt	181					181
Imperial	13	994			994	1,007
Inyo	19	30,063	1,017	59,510	90,590	90,609
Kern	83	195,365			195,365	195,448
Lassen, Modoc, and Colusa		2,813			2,813	2,813
Los Angeles		4			4	4
Madera	19	756			756	775
Mariposa	38	5,209			5,209	5,247
Merced and Stanislaus	1,100					1,100
Mono		72,677			72,677	72,677
Monterey		10			10	10
Nevada	2,848	45,087			45,087	47,935
Placer	1,881	988			988	2,869
Plumas	310	820			820	1,130
Riverside			46		46	46
Sacramento	5,492					5,492
San Bernardino		20,145	2,743	1,285	24,173	24,173
San Diego		3,310			3,310	3,310
Shasta	250	27,279	1,386,817		1,414,096	1,414,346
Sierra	608	1,233			1,233	1,841
Siskiyou	2,100	2,025			2,025	4,125
Trinity	2,283	2,144			2,144	4,427
Tuolumne	38	8,392			8,392	8,430
Yuba	7,863	129			129	7,992
Total	40,967	456,826	1,539,665	60,795	2,057,286	2,098,253

Comparisons of these totals for 1909 with the silver output of 1908 are as follows:

Mine production of silver in California in 1908 and 1909, by kinds of ore, in fine ounces.

Year.	Placers.	Deep mines.					Grand total.	
		Siliceous ore.	Copper ores.	Lead ores.	Copper-lead ores.	Total.	Quantity	Value.
1908	71,185	483,483	1,031,381	59,600	1,629	1,576,093	1,647,278	$873,057
1909	40,967	456,846	1,539,645	60,795		2,057,286	2,098,253	1,091,092
Increase (+) or decrease (−)	−30,218	−26,637	+508,264	+1,195	−1,629	+481,193	+450,975	+218,035

COPPER.

The mine production of copper in California in 1909 from all ores was 57,288,281 pounds, valued at $7,447,476. As compared with the figures of 1908 this was an increase in quantity of 18,511,400 pounds and an increase in value of $2,328,928. Copper was produced in the counties of Amador, Calaveras, Del Norte, Fresno, Humboldt, Imperial, Inyo, Mono, Riverside, San Bernardino, and Shasta. The heaviest production, as in previous years, was from Shasta County, which made an output of 50,013,511 pounds in 1909, valued at $6,501,757, from 723,772 tons of ore, an increase in quantity of 16,160,669 pounds and in value of $2,033,182. In 1908 this county produced 33,852,842 pounds, valued at $4,468,575, from 457,055 tons of ore. The next county in importance in 1909 in the production of copper was Calaveras, with an output of 5,416,315 pounds, valued at $704,121, followed in order by Fresno County, with a yield of 1,478,623 pounds, valued at $192,221. There were altogether 840,358 tons of copper ore treated in California in 1909. The copper ores of California also yielded 33,430.12 fine ounces of gold, valued at $691,062, and 1,539,665 fine ounces of silver, valued at $800,625. The total yield from copper ores alone in California in 1909 in copper, gold, and silver amounted in value to $8,925,258.

LEAD.

The quantity of lead produced in California in 1909 was 1,502,597 pounds, valued at $64,612. This was an increase in quantity of 265,049 pounds and in value of $12,635. The three counties of Inyo, Mono, and San Bernardino were the only producers in 1909, the largest quantity coming as usual from Inyo County, where there are 16 lead, silver-lead, and copper-lead mines. In 1909 this county produced 1,490,649 pounds of lead as compared with an output of 1,110,952 pounds in 1908, an increase of 379,697 pounds. The lead ore treated in the State in 1909 was 5,589 tons, of which 5,575 tons came from Inyo County, that from the other counties named having been obtained merely as a by-product. With the lead were obtained 434.17 fine ounces of gold, valued at $8,975, and 60,795 fine ounces of silver, valued at $31,613. The total yield of the lead industry in 1909 in California in lead, gold, and silver amounted in value to $105,200.

MINING INDUSTRY IN CALIFORNIA IN 1909.

The placer mines of the State are increasing their gold output more rapidly than are the deep mines. The hydraulic and surface placers show a decrease, but the drift and especially the dredge mines show an increase. The oldest dredging field in the State, that at Oroville, is naturally beginning to show a decrease in yield of gold, some of the companies having worked out their acreage and ceased operations, while others are now working in ground of an average value lower than formerly. In the Sacramento County field it is not expected that any increase of yield will be made, but the Yuba County dredging field, near Marysville, will undoubtedly materially increase its annual yield. There is a growing tendency to use dredges in smaller isolated areas in

Butte, Calaveras, Merced, Shasta, Stanislaus, Siskiyou, and Trinity counties. Search is being constantly made for other areas of this character, and much prospecting is being carried on.

Since the close of 1909 the copper smelting companies in Shasta County have been more or less hampered by being required to condense the fumes from their smelters. Two large companies have closed their smelting plants in that county, sending the ore elsewhere for treatment. Others have been compelled to curtail their output by using fewer furnaces in order to condense the fumes by mechanical appliances. All of this will doubtless reduce the copper output of the State in 1910.

In the section on production by counties in this report the dètails of deep-mining work in the Mother Lode counties are given. A condensed statement of the record of 1909 of these Mother Lode counties is given in the following table:

Tonnage of ore and value recovered in bullion in gold and silver mills, tonnage and value of concentrates produced, and total recovery, with average value per ton, in Mother Lode counties, California, in 1909.

County.	Ore to gold and silver mills.				Ore to concentrating mills, quantity.	Concentrates produced.				Total recovery.	Total average recovery per ton.
	Quantity.	Gold in bullion.	Silver in bullion.	Average value in gold and silver recovered on plates.		Quantity.	Gold.	Silver.	Average value in gold and silver.		
	Short tons.				*Short tons.*	*Short tons.*					
Amador......	466,530	$1,430,441	$7,047	$3.08	9,026	11,631	$812,398	$9,253	$70.64	$2,259,139	$4.75
Calaveras.....	505,831	660,501	2,841	1.31	....	12,276	437,448	5,667	36.09	1,106,457	2.18
Eldorado.....	27,431	125,095	696	4.58	....	523	49,820	383	95.99	175,994	6.42
Mariposa.....	52.087	324,193	2,381	6.27	16	727	66,531	328	91.96	393,433	7.55
Tuolumne....	286,281	523,858	3,710	1.84	2,328	10,878	391,131	633	36.01	919,332	3.18
Total...	1,338,160	3,064,088	16,675	2.30	11,370	36,035	1,757,328	16,264	49.22	4,854,355	3.60

The activity in deep mining in 1909 is evidenced by the increase in quantity of ore treated. This reached 3,041,688, which was an increase of 494,780 tons. The average recovered value per ton of the ore sent to gold and silver mills was $3.83 in 1909 and $4.12 in 1908. The concentrates averaged in recovered value per ton in gold $51.21 in 1908 and $49.81 in 1909. The average value per ton in gold of the smelting ore and in the tailings treated also decreased in 1909.

Of siliceous ores alone—2,195,741 tons—the total value in gold and silver was $10,670,950, or an average of $4.86 per ton. The value of these ores in all metals was $10,682,559, or an average of $4.87 per ton. There were 840,358 tons of copper ore produced, with a total value in gold and silver of $1,491,688, or an average value of $1.78 per ton. The total value of this ore in all metals was $8,925,258, or an average value of $10.62 per ton. The lead ores amounted to 5,589 tons, yielding gold and silver valued at $40,588, or an average value of $7.26 per ton; or, in all metals, $107,497, or $19.23 per ton.

The total tonnage, by kinds of ore treated or sold in each county in California in 1909, is shown in the following table:

Subdivision of tonnage of crude ore sold or treated in California in 1909, by counties, in short tons.

County.	Siliceous ore.	Copper ores.	Lead ores.	Copper-lead ores.	Total ore.
Amador	471,674	9,000			480,674
Butte	1,316				1,316
Calaveras	505,835	60,830			566,665
Del Norte		287			287
Eldorado	27,431				27,431
Fresno	596	45,960			46,556
Humboldt	15	7			22
Imperial	5,793	1			5,794
Inyo	73,990	60	5,575		79,625
Kern	242,104				242,104
Lassen, Modoc, and Colusa	17,389				17,389
Los Angeles	96				96
Madera	1,779				1,779
Mariposa	52,103				52,103
Mono	48,536				48,536
Monterey	25				25
Nevada	232,034				232,034
Placer	13,865				13,865
Plumas	27,795				27,795
Riverside		32			32
San Bernardino	3,976	459	14		4,449
San Diego	1,707				1,707
Shasta	130,534	723,722			854,256
Sierra	17,766				17,766
Siskiyou	19,009				19,009
Trinity	9,882				9,882
Tuolumne	288,618				288,618
Yuba	1,873				1,873
Total	2,195,741	840,358	5,589		3,041,688
Increase (+) or decrease (−)	+170,147	+326,944	−1,943	−368	+494,780
Average value per ton in gold and silver	$4.86	$1.78	$7.26		$4.01

The subdivision of tonnage and production of gold and silver in California in 1909, according to methods of treatment, is shown in the following table:

Subdivision of tonnage and production of gold and silver in California in 1909, according to methods of treatment, by counties.

County.	Ore to gold and silver mills.			Concentrates produced.		
	Tonnage.	Gold.	Silver.	Tonnage.	Gold.	Silver.
Amador	466,530	$1,430,441	$7,047	11,631	$812,398	$9,253
Butte	1,310	22,400	45	1	500	
Calaveras	505,831	660,501	2,841	12,276	437,448	5,667
Del Norte						
Eldorado	27,431	125,095	696	523	49,820	383
Fresno	596	10,108	55			
Humboldt	15	55				
Imperial	5,752	57,900	507		992	10
Inyo	50,567	372,757	8.357	26	8,128	201
Kern	221,488	602,291	65,220	336	29,668	29,795
Lassen, Modoc, and Colusa	16,389	114,358	1,438			
Los Angeles	96	864	2			
Madera	1,779	11,966	393			
Mariposa	52,087	324,193	2,381	727	66,531	328
Mono	26,134	263,607	16,314	528	8,190	179
Monterey	23	236	4			
Nevada	231,954	2,042,895	19,319	4,087	222,726	4,126
Placer	13,865	77,002	481	82	3,600	33
Plumas	27,745	105,314	425	5	413	1
Riverside						
San Bernardino	1,931	18,647	2,204	240	4,713	318
San Diego	1,522	12,262	1,716	5	310	4
Shasta	39,767	571,195	2,369	185	27,743	114
Sierra	17,763	82,912	569			
Siskiyou	19,009	183,363	1,040	41	3,823	13
Trinity	8,769	134,437	706	18	3,266	59
Tuolumne	286,281	523,858	3,710	10,878	391,131	633
Yuba	1,873	13,760	67			
Total	2,026,507	7,762,417	137,906	41,589	2,071,400	51,117
Average value per ton		3.83	.07		49.81	1.23

Subdivision of tonnage and production of gold and silver in California in 1909, according to methods of treatment, by counties—Continued.

County.	Crude ore to smelters.			Old tailings treated.		
	Tonnage.	Gold.	Silver.	Tonnage.	Gold.	Silver.
Amador	118	2,782	18	5,000	11,514	183
Butte	6	1,876	22			
Calaveras	60,834	85,513	62,245			
Del Norte	287	466	49			
Eldorado						
Fresno	45,960	6,315	8,437			
Humboldt	7					
Imperial	1					
Inyo	1,668	8,512	25,044	27,312	68,274	13,505
Kern	35	2,213	6,247	5,911	17,384	328
Lassen, Modoc, and Colusa				1,000	1,969	25
Los Angeles						
Madera						
Mariposa						
Mono	84	2,150	262	22,318	80,962	21,037
Monterey	2	97	1			
Nevada						
Placer						
Plumas						
Riverside	32	186	24			
San Bernardino	1,096	16,711	10,048			
San Diego				150	240	1
Shasta	812,775	966,419	732,713	1,704	3,680	134
Sierra	2	2,687	12	1	741	60
Siskiyou						
Trinity	53	12,980	321	959	1,099	29
Tuolumne	9	4,850	21			
Yuba						
Total	922,969	1,113,757	845,464	64,355	185,863	35,302
Average value per ton		$1.21	$0.92		$2.89	$0.55

Average recovery per ton from bullion and concentrates: Gold, $4.79; silver, $0.09. There were 27,857 tons of crude ore sent to mills using concentration alone.

Reports were received from 1,127 producing mines in California, in 1909, as shown by the following table:

Number of producing mines in California, classified by chief product in 1909, by counties.

County.	Gold placer mines.					Deep mines.					Total mines reporting product.
	Hydraulic.	Dredging.	Drift.	Surface.	Total.	Gold.	Silver and silver-gold.	Copper.	Lead, silver-lead, copper-lead.	Total.	
Amador	3		4	18	25	24		2		26	51
Butte	2	30	5	6	43	6				6	49
Calaveras	3	3	26	17	49	42		3		45	94
Del Norte				1	1			1		1	2
Eldorado			8	19	27	21				21	48
Fresno				1	1	5		1		6	7
Humboldt	14			1	15	1		1		2	17
Imperial				1	1	4		1		5	6
Inyo				1	1	16		1	16	33	34
Kern			1	2	3	49	1			50	53
Lassen, Colusa, and Modoc						3				3	3
Los Angeles						3				3	3
Madera				1	1	11				11	12
Mariposa				5	5	29				29	34
Merced, Shasta, and Stanislaus		4		7	11						11
Mono						13				13	13
Monterey						3				3	3
Nevada	2		8	5	15	41				41	56
Placer	2		40	32	74	18				18	92
Plumas	1		6	33	40	14				14	54
Riverside								2		2	2
Sacramento		8	1	3	12						12
San Bernardino						19	9	6	1	35	35
San Diego						10				10	10
Shasta		(a)		(a)	(a)	28	2	4		34	34
Sierra	11		12	16	39	20				20	59
Siskiyou	52	3	3	49	107	48				48	155
Trinity	42		1	12	55	34				34	89
Tuolumne	1		3	1	5	48				48	53
Yuba	1	15		10	26	10				10	36
	134	[b] 63	118	241	556	520	12	22	17	571	1,127

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[a] Placers included in Merced, Shasta, and Stanislaus.

[b] Number of dredges, not companeis.

PRODUCTION BY COUNTIES.

AMADOR COUNTY.

Amador is the most productive of the Mother Lode counties of the State, and for the year 1909, increased the value of its total output by $443,528, as shown by the following table:

Mine production of Amador County, Cal., in 1908 and 1909.

Year.	Gold.		Silver.		Copper.		Total value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
	Fine oz.		*Fine oz.*		*Pounds.*		
1908	90,759.92	$1,876,174	24,980	$13,239	55,788	$7,364	$1,896,777
1909	111,203.72	2,298,785	32,118	16,701	113,995	14,819	2,330,305
Increase	20,443.80	422,611	7,138	3,462	58,207	7,455	433,528

The largest increase was in the gold, but both silver and copper also increased. The total tonnage of the county in 1909 was 480,674 tons, of which 118 tons of copper ore were shipped to smelter, and 466,530 tons, or 97.04 per cent of the total tonnage, was treated at gold and silver mills. From this milling ore $1,430,441 in gold and $7,047 in silver was saved as gold bullion, an average, respectively, of $3.09 and $0.01 per ton. The total gold and silver obtained as bullion was valued at $1,437,488, an average of $3.10 per ton. From this 466,530 tons of milling ore and 9,026 tons of ore sent to concentrating mills were obtained 11,631 tons of concentrates, which yielded $812,398 in gold, an average of $69.84 per ton, and $9,253 in silver, an average of 80 cents per ton, a total average of $70.64 per ton in gold and silver. The total extraction of gold from bullion and concentrates was $2,242,839, an average of $4.72 per ton, and the value of the silver was $16,300, an average of $0.03 per ton. The value of the total yield of both gold and silver from milling ore, and ore to concentrating mills, was, therefore, $2,259,139, an average value of $4.75 per ton. The yield of the placers of the county was 2,014.82 fine ounces of gold, valued at $41,650, and 385 ounces of silver, valued at $200. In 1909, the few deep mines at Amador City produced 70,291 tons of ore, yielding $377,857 in gold and $1,556 in silver, a total of $379,413. By far the largest proportion of the output of the county came from the district at Jackson and Sutter Creek, where the deep mines made a combined output of 330,857 tons of ore, yielding $1,642,461 in gold and $7,554 in silver, a total of $1,650,015. The producing deep mines in Jackson and Sutter Creek district are the Amador Queen No. 2, Argonaut, Kennedy, Oneida, Zeila, and South Eureka. Two of these mines, the Kennedy and the Argonaut, have the deepest shafts in the State, and the Kennedy is the second in rank among the deep-mine gold producers of the State. Other large producers among the deep mines of this county are the Bunker Hill Consolidated Mining Company and the Keystone Consolidated Mining Company, at Amador City, and the Fremont Consolidated Mining Company, at Drytown. The placer mines in Oleta district yielded a total of $2,742 in gold and silver, and those in Volcano district, $28,420. At Oleta, the mines are small sluicing properties, and at Volcano there are hydraulic, drift, and sluicing mines, the most productive being a hydraulic mine.

BUTTE COUNTY.

Dredging operations in Butte County have made it the leading county of the State in gold production, yet there is an apparent decrease in 1909, as shown by the following table:

Mine production of Butte County, Cal., in 1908 and 1909.

Year.	Gold.		Silver.		Total.
	Quantity.	Value.	Quantity.	Value.	
	Fine ozs.		*Fine ozs.*		
1908	151,868.38	$3,139,398	23,978	$12,708	$3,152,106
1909	144,499.95	2,987,079	13,856	7,205	2,994,284
Decrease	7,368.43	152,319	10,122	5,503	157,822

The productive mines in this county in 1909 comprised 2 hydraulic, 30 dredge, 5 drift, and 6 surface placers, and 6 deep gold mines, 49 in all. The deep mines are at Forbestown, Hurleton, Oroville, Stirling City, and Yankee Hill. The drift mines of the county yielded $13,597 in gold in 1909, the hydraulic mines, $15,265, the surface or sluicing mines, $43,168, and the dredges, $2,890,273.

Oroville is the most productive gold mining locality in the State, by reason of the large number of gold dredges at work there. These dredges produced in 1909, $2,743,232 out of $2,987,079 of gold for the whole county.

The following table shows the output of gold from the Oroville dredging field for several years past, with the increase or decrease:

Gold output of Oroville, Cal., dredging district, 1903-1909, with increase (+) or decrease (−), by years.

1903	$1,329,998	
1904	1,632,507	+$302,509
1905	2,261,887	+ 629,380
1906	2,768,782	+ 506,895
1907	2,697,092	− 71,690
1908	3,043,151	+ 346,059
1909	2,743,232	− 299,919

These figures do not show, as they did in former years, the total output of gold from dredging operations in Butte County, since 4 dredges were put in operation in 1909 in other districts of the county. One of these is in Butte Creek district, 10 miles from Chico; 1 in Honcut Creek district, 12 miles from Oroville; and 2 in Wymans Ravine district, 4 miles from Oroville. The combined gold yield of these 4 dredges in the outside districts in 1909 was $147,041, which sum, added to the combined yield of the dredges in the Oroville district, makes a total of $2,890,273 gold, as the result of dredging operations in Butte County for 1909.

In 1909 the following dredging companies were operating in the Oroville field; Boston and California Dredging Company, Butte

Dredging Company, Boston and Oroville Mining Company, El Oro Dredging Company, Natomas Consolidated of California (Feather River division), Gold Run Dredging Company, Indiana Gold Dredging Company, Leggett Gold Dredging Company, Nevada and Ophir Dredge, Oroville Gold Dredging and Exploration Company, Oro Water, Light and Power Company, Pacific Gold Dredging Company, Pennsylvania Dredging Company, and Viloro Syndicate (Limited). Altogether these companies operated 26 dredges, or 8 less than were working in 1908.

In Wymans Ravine district the Leggett Mining Company and the Gardella Gold Dredging Company each operated 1 dredge; in Honcut Creek district, the Kentucky Ranch Gold Dredging Company operated 1 dredge; and in Butte Creek district, the Butte Creek Consolidated Dredging Company operated 1 dredge. These machines began operations in April, May, and September, 1909, so none of them ran a full year.

The total number of dredges operated in Butte County in 1909 was 30, as compared with 34 in 1908. In the Oroville field 1 dredge stopped operating in June, 1 in August, 1 in September, 1 in November, and 2 on the last day of 1909. One new dredge was constructed during 1909. It is interesting to note that the dredge which ceased operations in June, 1909, had run five years and two months; that which ceased in August had operated seven years and four months; that which ceased work in September had worked four years and ten months; and that which stopped in November had operated ten years and four months. Of the 2 which stopped on December 31, 1 had been in operation seven years, and the other seven years and six months.

CALAVERAS COUNTY.

Mine production of Calaveras County, Cal., in 1908 and 1909.

Year.	Gold.		Silver.		Copper.		Total value
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
	Fine ounces.		*Fine ounces.*		*Pounds.*		
1908	66,685.47	$1,378,511	118,353	$62,727	4,473,030	$590,440	$2,031,678
1909	69,684.72	1,440,511	137,342	71,418	5,416,315	704,121	2,216,050
Increase	2,999.25	62,000	18,989	8,691	943,285	113,681	184,372

Calavaras County in 1909 increased the value of its output of gold, silver, and copper by $184,372. In the county were 3 productive hydraulic mines, 3 dredges, 26 drift mines, and 17 surface placers, or 49 placers, and 42 deep gold mines and 3 copper mines a total of 94. In siliceous ores the tonnage of this county was larger than that of any other county in the State, the quantity being 505,835 tons. In addition there were 60,830 tons of copper ore treated.

The total tonnage of ore yielded 57,249.98 fine ounces of gold, valued at $1,183,462, with 136,063 fine ounces of silver, valued at $70,753, and 5,416,315 pounds of copper, valued at $704,121. The output of placer gold was 12,434.74 fine ounces, valued at $257,049, and of placer silver, 1,279 ounces, valued at $665. The total output of the county in 1909 in gold, silver, and copper was valued at $2,216,050.

There were 505,831 tons of ore treated at gold and silver mills, being 89.27 per cent of the tonnage of the county in 1909. From this was obtained gold in bullion valued at $660,501, or $1.30 per ton, and $2,841 in silver—less than 1 cent per ton. The total saving in bullion was valued at $663,342, or $1.31 per ton. From this quantity of ore 12,276 tons of concentrates were produced, yielding $437,448 in gold and $5,667 in silver, a total of $443,115, and an average of $35.63 per ton in gold and of $0.46 per ton in silver, or a total of $36.09 per ton. The milling ore then yielded a total of $1,097,949 in gold, the total average recovery per ton being $2.16. Of silver the total average recovery was less than 2 cents per ton. The total gold and silver recovered was therefore valued at $2.17 per ton.

The principal producing deep mines of the county are at Angels, where are located the Angels Quartz Mining Company, the El Dorado mine, and the Etna King, the Lightner, and the Utica mining companies. The mines in this district produced 349,135 tons of ore in 1909, which yielded $787,998 in gold and $3,463 in silver, a total of of $791,461. The 11 small quartz producers in West Point district produced 290 tons of ore valued at $5,862 in gold and silver. The Melones Mining Company, at Melones, is, except the mines at Angels, the largest gold producer in the county. The most productive copper mine is the Penn Chemical Company's property at Campo-Seco. Other deep productive mines are at Carson Hill (or Irvine), Copperopolis, Esmeralda, Felix, Glencoe, Jenny Lind, Milton, Mokelumne Hill, Mountain Ranch, Murphy, North Branch, Railroad Flat, Sheep Ranch, and Vallecito. The largest production from placers was from Jenny Lind district, where the mines, including two dredges, yielded $164,076 in gold and $350 in silver.

In Mokelumne Hill district the placer gold yield was $7,135 and at San Andreas, $10,062. Three dredge mines in this county yielded in 1903 $211,814 in gold; 26 drift mines produced $24,982; 17 surface or sluicing mines, $11,417; and 3 hydraulic mines, $8,836.

ELDORADO COUNTY.

Eldorado, which is one of the five Mother Lode counties of California, produced in 1909 11,527.00 fine ounces in gold, valued at $238,284, and 2,498 fine ounces of silver, valued at $1,299, a total of $239,583. The decrease in value of output for 1909 was $107,954. The ore treated from the deep mines amounted to 27,431 tons, which yielded 8,461.52 fine ounces of gold, valued at $174,915, and 2,075 fine ounces of silver, valued at $1,079, a total value of $175,994. The placer mines of the county yielded 3,065.48 fine ounces of gold, valued at $63,369 and 423 ounces of silver, valued at $220, a total f $63,589. Of the placer gold, $34,520 came from 8 drift mines, nd $28,849 from 19 surface or sluicing mines.

In Eldorado County 27,431 short tons of ore was mined and all was treated at gold and silver mills. The gold saved on plates was 125,095, or an average of $4.55 per ton, and the silver was valued t $696, or $0.03 per ton, the total recovery from the plates being alued at $125,791, an average value of $4.58 per ton. There were 223 tons of concentrates derived from the milling ore, which yielded

$49,820 in gold and $383 in silver, a total of $50,203 in gold and silver, or $95.26 in gold per ton and $0.73 in silver, an average of $95.99 per ton in both gold and silver. The ore milled yielded, therefore, on the plates and from the concentrates, a total of $174,915 in gold, or an average per ton of $6.38, and silver valued at $1,079, or $0.04 per ton, or a total value for gold and silver of $175,994, or $6.42 per ton. This average value is much lower than that reported in 1908, owing to the fact that in 1908 one mine obtained exceptionally rich ore from one ton of ore found in a pocket. Something of the same kind occurred in 1909 also, but not to so great an extent.

Reports were received from 48 producing mines in the county, of which 27 were placers and 21 deep mines. The principal deep mine producers in the county are the Union and the Independence, at Eldorado, and the Sherman, near Placerville. Deep mines are also productive at Coloma, Diamond Springs, Greenwood, Georgetown, Grizzly Flat, Josephine, Jurgens, Nashville, Park, Pilot Hill, Rescue, and Salmon Falls. The placer mines in the Placerville district yielded during the year $32,636 in gold; in Georgetown district, $20,474; in Fairplay district, $3,282; and in Omo Ranch district, $1,229. The most productive placers are the drift mine of the Eldorado Water and Deep Gravel Mining Company, at Placerville; the Beattie and Parsons sluice mine, at Georgetown; and the Pacific, at Georgetown. Other placers are worked at Green Valley, Indian Diggings, Rescue, and Shingle.

DEL NORTE AND HUMBOLDT COUNTIES.

Del Norte and Humboldt counties lie contiguous on the coast line in the extreme northwestern portion of the State.

Del Norte County made a total production of gold, silver, and copper, valued at $9,742 in 1909, or a decrease of $3,360, as compared with the value of the output of 1908. There is 1 small placer mine near Crescent City, and 1 deep mine at Smith River. The principal production of the county was in copper, of which the yield was 62,154 pounds, valued at $8,080. Copper began to be produced in this county for the first time in 1908.

Humboldt County has 1 deep gold mine, 1 copper mine, and 15 placers. Of the latter, 14 are hydraulic mines and 1 a surface or sluicing mine. The total yield in Humboldt County for 1909 was valued at $26,278, of which $25,690 was in gold and $94 in silver. There were also produced 3,798 pounds of copper, valued at $494. The value of the total yield of the county in 1909 was $7,113 less than in 1908. Almost the entire gold output of the county came from the hydraulic mines along Klamath River, at and near Orleans.

FRESNO COUNTY.

The production of Fresno County in 1909 in gold, silver, and copper was valued at $218,263, or nearly 100 per cent more than in 1908, the largest percentage of increase in any county of the State for the year. Of the total value, $17,539 was in gold, $8,503 in silver, and $192,221 in copper. There were 1 productive placer mine and 6 deep mines in 1909. Most of the silver was obtained from smelting copper ores. The producing deep mines were at Auberry, Clovis, Ockenden, Friant, and Toll House. The quantity of ore treated in the county in 1909 was 46,556 tons, the larger part of which was smelted.

INYO COUNTY.

Mine production in Inyo County, Cal., in 1908 and 1909.

Metal.	1908.		1909.		Increase.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold.................fine ounces..	14,941.73	$308,873	22,148.30	$457.846	7,206.57	$148,973
Silver.......................do....	58,302	30,900	90,609	47,117	32,307	16,217
Copper..................pounds..	3,690	487	31,722	4,124	28,032	3,637
Lead.........................do....	1,110,952	46,660	1,490,649	64,098	379,697	17,438
Total............................	....	386,920	....	573,185	....	186,265

Thirty-four mines produced in Inyo County in 1909, including 1 placer, 16 deep gold mines, 1 copper mine, and 16 lead, silver-lead, and copper-lead mines. The deep mines produced 79,625 tons of ore in 1909, an increase of 40,185 tons.

As the table shows, there was a considerable increase in the gold production and minor gains in the other metals.

In the Keeler district the mines produced 5,229 tons of ore, yielding $8,339 in gold, $27,623 in silver, 13,185 pounds of copper, and 129,628 pounds of lead, or a total value of $93,416. At Darwin the output was 143 tons of ore, yielding $1,433 in gold, $1,738 in silver, 454 pounds of copper, and 76,279 pounds of lead. In Ballarat district the output was 727 tons of ore, yielding $6,601 in gold and $113 in silver, a total value of $6,714. In Big Pine district 119 tons of ore yielded $1,005 in gold, $878 in silver, 208 pounds of copper, and 43,070 pounds of lead, a total value of $3,762. The most important producer in the county is the Skidoo Mines Company, at Skidoo, and other important producers are the Keane Wonder, near Rhyolite, Nev., the Arondo Gold Mining Company, near Searles, and the Four Metals Company, at Keeler.

There were treated in Inyo County in 1909, 79,625 short tons of ore, of which 73,990 tons were siliceous ores, 60 tons were copper ores, and 5,575 tons were lead ores. The deep mines in 1909 yielded 22,139.83 fine ounces of gold, valued at $457,671, and the placers, 8.47 fine ounces, valued at $175. The deep mines also yielded 90,590 ounces of silver, valued at $47,107, and the placers 19 ounces, valued at $10. The gold obtained from the siliceous ores was 21,719.64 fine ounces, valued at $448,985, and that derived from the lead ores was 420.19 fine ounces, valued at $8,686. From the copper ores no gold was obtained. The silver from the siliceous ores was 30,063 ounces, valued at $15,633; from the copper ores, 1,017 fine ounces, valued at $529; and from the lead ores, 59,510 ounces, valued at $30,945. The siliceous ores yielded, therefore, $464,618 in gold and silver, the copper ores yielded $529 in silver, and the lead ores $39,631 in gold and silver, a total of $504,778 in gold and silver from deep mines.

KERN COUNTY.

Mine production in Kern County, Cal., in 1908 and 1909.

Year.	Gold.		Silver.		Copper.		Total.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
	Fine ounces.		*Fine ounces.*		*Pounds.*		
1908	40,010.33	$827,087	182,170	$96,550	144	$19	$923,656
1909	31,675.90	654,799	195,448	101,633			756,432
Increase (+) or decrease (−)	−8,334.43	−172,288	+13,278	+5,083	−144	−19	−167,224

The silver output in Kern County increased in value by $5,083 in 1909, but the gold yield declined $172,288, and there was no production of copper, the total decrease in value of all metals being therefore $167,224 for 1909. There were 242,104 tons of ore treated, which yielded 31,519.02 fine ounces of gold, valued at $651,556, and 195,365 ounces of silver, valued at $101,590. Three placers yielded 156.88 fine ounces of gold, valued at $3,243, and 83 ounces of silver, valued at $43. Fifty deep mines produced, all of which were gold mines except one, which yielded more silver than gold.

The most productive district in the county is that of Randsburg, where the mines produced 188,319 tons of ore, yielding $513,835 in gold and $4,800 in silver, a total of $518,635. The producers in this district were the Baltic, Consolidated Mining Company, Gold Bug, Butte Lode, La Crosse, Minnesota group, Minnehaha group, Napoleon Consolidated Mining Company, Pearl Wedge and Madera, Sydney, Sunshine, Stanford Mining and Reduction Company, Winnie, and Yellow Aster. The last named is the largest and most productive mine in the county. In Isabella district the Buster Brown, New Century, Mammoth and Pennsylvania, Old Keyes, and Shoestring mines made a combined production of 289 tons of ore, yielding $7,685 in gold and $77 in silver. In Piute district the Bowman, Bryan Chief, Gold State, Lulu, Mace, Linepine No. 4, and Standard mines made a combined production of 287 tons of ore, yielding $9,114 in gold and $108 in silver. Next to the Yellow Aster, the most productive gold mine in the county was the Queen Esther, at Mohave. Other productive deep mines are at Amalie, Bodfish, Glenville, Havilah, Johannesberg, Caliente, Paris, Piute, Rosamond, and Woody. The few placers are at Isabella and Weldon.

The deep mines produced 242,104 tons of siliceous ore, of which 35 tons were sent to smelter, 14,670 tons were treated at concentrating mills, and 221,488 tons were sent to gold and silver mills. There were also treated 5,911 tons of old tailings. The yield in bullion from this total tonnage was $602,291 in gold, or $2.72 per ton, and $65,220 in silver, or $0.29 per ton. The total gold and silver in bullion was $667,511, or an average yield of $3.01 per ton. From this ore and that sent to concentrating mills were derived 336 tons of concentrates, which yielded $29,668 in gold and $29,795 in silver. The concentrates therefore yielded $88.30 per ton in gold and $88.68 per ton in silver, or average yield of $176.98 per ton in both gold and silver. The total yield on the plates and from the concentrates was $631,959 in gold, or an average of $2.68 per ton, and a total of $95,015 in silver, or an average of $0.40 per ton. The total yield of both gold and silver from this ore was $726,974, or an average total value of ore treated of $3.08 per ton.

MARIPOSA COUNTY.

Mariposa is one of the Mother Lode counties of California, and had in 1909 a total production of $399,194, or $50,252 less than in 1908. The output of gold in 1909 was 19,178.99 fine ounces, valued at $396,465, and of silver 5,247 ounces, valued at $2,729. The placer gold amounted to 277.72 fine ounces, valued at $5,741, and the placer silver was 38 ounces, valued at $20. The deep mines produced 52,103 tons of siliceous ore, of which 16 tons went to concentrating mills. The remainder went to gold and silver mills and yielded $324,193 in gold in bullion, or $6.23 per ton, and $2,381 in silver, or $0.04 per ton, the total gold and silver in bullion being $326,574, or an average yield of $6.27 per ton. From all ore concentrated were derived 727 tons of concentrates, which yielded $66,531 in gold and $328 in silver, a total of $66,859. The concentrates therefore yielded $91.51 per ton in gold and $0.45 per ton in silver, an average yield of $91.96 per ton in both gold and silver. The siliceous ore therefore yielded on the plates and from the concentrates a total of $390,724 in gold, or an average of $7.50 per ton, and a total of $2,709 in silver, or an average of $0.05 per ton. The total yield of both gold and silver from this ore was $393,433, or an average total value of the ore treated of $7.55 per ton.

Twenty-nine deep gold mines were productive in the county in 1909, and 5 placers, the latter all sluicing mines.

The most productive district in the county is at Hornitos, where the mines made a production of 30,622 tons of ore, yielding $221,989 in gold and $1,472 in silver, a total of $223,461. This was derived from the Mount Gains, Hornitos, Martinez, "1909", and Ruth Pierce mines. In Jerseydale district the Hite, Big Bonanza, and Early and Revel mines made a combined production of 2,620 tons of ore, yielding $18,586 in gold and $120 in silver. At Coulterville the pocket mines yielded $13,708 in gold and $75 in silver, and the other mines 2,175 tons of ore, yielding $13,119 in gold and $131 in silver. The Coulterville mines therefore yielded $27,033 in gold and silver for the year. There was also a large yield from one mine at Bagby, belonging to the Mariposa Commercial and Mining Company, and productive mines were reported from Bear Valley, Kingsley, Blanchard, El Portal, Mariposa, Mount Bullion, and Whitlock. The most productive mine in the county in 1909 was that of the Mount Gaines Mining Company, at Hornitos.

MONO COUNTY.

In 1909 Mono County produced metal valued at $393,175, as compared with a total value of $440,182 in 1908, a decrease of $47,007. The gold derived from 48,536 tons of ore was 17,168.72 fine ounces, valued at $354,909, and the silver was 72,677 ounces, valued at $37,792. From this tonnage of ore was also produced 3,454 pounds of copper, valued at $449, and 582 pounds of lead, valued at $25. There were 13 producing mines in the county, all deep gold mines.

The principal producing district in the county is Bodie, where the mines produced 35,900 tons of ore, yielding $215,733 in gold, and silver valued at $36,514, or a total value of $252,247. The producing mines were the New Bodie, the Cain, the Burkham, and the Standard, the latter the largest producer in the county. At Lundy district the Crystal, Dauntless, Harrison, and Wolverine mines combined produced 5,140 tons of ore, yielding $32,366 in gold and $416 in silver, a total of $32,782. The Pittsburg-Liberty Mining Company, at Masonic, was, next to the Standard Consolidated of Bodie, the largest producer in Mono County. The Casa Diablo Mining Company, at Sherwin, and the St. Ives, at Benton, also made considerable production. The copper and lead were obtained as by-products of the gold mines.

NEVADA COUNTY.

Mine production of Nevada County, Cal., in 1908 and 1909.

Year.	Gold.		Silver.		Total.
	Quantity.	Value.	Quantity.	Value.	
	Fine ozs.		*Fine ozs.*		
1908	111,163.96	$2,297,963	41,347	$21,914	$2,319,877
1909	128,688.86	2,660,235	47,935	24,926	2,685,161
Increase	17,524.90	362,272	6,588	3,012	365,284

In Nevada County the metallic output for 1909 showed an increase in value of $365,284 over that of 1908. The tonnage treated in 1909 was 232,034 as compared with 220,064 in 1908, an increase of 11,970 tons in 1909. There were 56 productive mines in the county in 1909, of which 41 were deep gold mines and 15 were placers. Of these latter 2 were hydraulic, 8 drift, and 5 sluicing mines. The placer gold aggregated in value $394,614, of which $11,306 came from hydraulic mines, $368,476 from drift mines, and $14,832 from surface or sluicing properties. The deep mines produced 109,599.42 fine ounces of gold, valued at $2,265,621 and 45,087 ounces of silver, valued at $23,445, a total of $2,289,066.

Nevada County made the largest production of gold from deep mining in 1909 in the State, and also made the largest production from drift mines, the latter due to an unusually rich find in a drift mine worked by Chinese operators at You Bet.

There were 231,954 tons of siliceous ore treated at gold and silver mills in the county in 1909, and 80 tons were treated at concentrating mills. The value of gold saved as bullion was $2,042,895, or $8.81 per ton, and the value of silver was $19,319, or $0.08 per ton. The total value of gold and silver recovered as bullion was $2,062,214, or an average of $8.89 per ton.

From the total ore treated there were obtained 4,087 tons of concentrates, which yielded $222,726 in gold, or an average of $54.49 per ton, and $4,126 in silver, or an average of $1.01 per ton. The total value of concentrates was $226,852 in gold and silver, or an average value of $55.50 per ton.

From the total tonnage and from bullion and concentrates, $2,265,621 in gold was recovered, or an average value of $9.76 per ton. and silver valued at $23,445, or an average of $0.10 per ton.

The value of the total gold and silver obtained as bullion and from concentrates was $2,289,066, the average of all the ore milled being $9.86 per ton in gold and silver. In 1908 the average value of all ores milled in the county in gold and silver was $10.14; in 1907 it was $9.06 per ton, and in 1906 it was $8.74 per ton.

The principal quartz-mining district of Nevada County is that of Grass Valley, which includes the mines in both Grass Valley and Nevada City. The following table shows the production of Grass Valley district in 1908 and 1909:

Production of Grass Valley and Nevada City quartz mines, Nevada County, Cal., 1908 and 1909.

Year.	Grass Valley mines.			Nevada City mines.			Grand total.
	Gold.	Silver.	Total.	Gold.	Silver.	Total.	
1908	$1,869,176	$11,953	$1,881,129	$192,037	$8,552	$200,589	$2,081,718
1909	2,005,574	16,540	2,022,114	171,604	1,971	173,575	2,195,689
Increase (+) or decrease(−)	+136,398	+4,587	+140,985	−20,433	−6,581	−27,014	+113,971

The Grass Valley deep mines increased the value of their output for 1909 by $140,985, and the Nevada City mines decreased their yield in the same period by $27,014. The increase of yield from the mines of the entire district was valued at $113,971. In Grass Valley district is the most productive deep gold mine in the State, that of the North Star Mines Company, which made a total yield in the calendar year 1909 of $1,237,793 in gold and $7,384 in silver, a total of $1,245,177, or $156,574 more than in 1908.

The Grass Valley quartz mines produced 78 per cent of the tonnage of the whole county, and the mines of Nevada City 11 per cent, the district of Grass Valley having produced therefore 89 per cent of all the ores milled in Nevada County in 1909. The Grass Valley deep mines produced $2,005,574, or 88.5 per cent of the quartz gold obtained in Nevada County in 1909, and 70.5 per cent of the quartz silver, or 88.3 per cent of the total values derived from the quartz ores. The Nevada City deep mines produced $171,604, or 7.6 per cent of the quartz gold of the county and 8.4 of the quartz silver. This was 7.6 per cent of the total value derived from quartz ores of the county.

Grass Valley district (including the Grass Valley and the Nevada City mines) produced 96.1 per cent of the quartz gold, 79 per cent of the quartz silver, and 95.9 per cent of all the gold and silver derived from the quartz mining operations in Nevada County in 1909.

The producing quartz mines in Grass Valley in 1909 were the Ben Franklin, Bryden, Central Consolidated, Empire, Golden Gate, Idaho-Maryland, Kenosha, North Star, Norambagua, Prudential, Pennsylvania Consolidated, Sultana, Sunflower, and Union Hill. The deep mine producers at Nevada City were the Austin, Bellefontaine, Champion Mines, Lecompton, Mayflower, Murchie, Mountaineer, Oustomah, Native Son, Pittsburg, and Zeibright.

In Graniteville district the Ancho, Birchville, Dillon, Golden State, and Republic mines made a combined output of 10,469 tons of ore, yielding $44,922 in gold and $289 in silver, a total of $45,211. Productive deep mines were also worked at Gaston, Maybert, North Bloomfield, North Columbia, Rough and Ready, and Washington.

Productive placers of different kinds were worked at French Corral, Grass Valley, Lowell Hill, North Bloomfield, Rough and Ready, Washington, and You Bet. At the latter place the largest yield of gold from any drift mine in the State was reported, but it was in the nature of pockets, in "pot-holes," in the bedrock, and work was discontinued in the early part of 1910.

PLACER COUNTY.

In 1909 Placer County produced gold and silver valued at $282,864, as against $360,290 in 1908. The total gold yield in 1909 was 13,611.37 fine ounces, valued at $281,372, and that of silver was 2,869 ounces, valued at $1,492. The deep mines produced from 13,865 tons of siliceous ore 3,899.12 fine ounces of gold, valued at $80,602, and 988 ounces of silver, valued at $514. The placer-mine yield was 9,712.25 fine ounces of gold, valued at $200,770, and 1,881 ounces of silver, valued at $978. Of this placer gold $2,242 was derived from 2 hydraulic mines, $135,716 from 40 drift mines, and $62,812 from 32 surface or sluicing mines. There were 74 placer mines and 18 deep gold mines productive in the county in 1909.

The drift mines and small placers at Bullion, including the Damascus, Mitchell Dix tunnel lease, Hidden Treasure, Drift, Mitchell, Red Point tailings, and Red Point lease produced $34,982 in gold. In Dutch Flat district the yield from three mines was $1,949 in gold. At Forest Hill the Black Hawk and Buckeye, Ceonothers, Dardanelles, Eureka Consolidated Drift, Lehigh, American Brand, Paragon, Big Bend, and St. George mines, mostly drift, made a combined yield of $25,339 in gold. At Gold Run the Canyon Creek, Gophertown, Indian Hill Canyon, Oregon Gulch and Secret Town, Washington, and United mines, all combined, obtained $35,877 in gold. In Iowa Hill district the Booth River, Carrie, "Drift," Gleason Consolidated, Excelsior, Kinder lease, Gould, Phillips, and General Grant, Big Dipper lease, McGeachin placer, Morning Star, Kinder River placer, San Francisco, Selby, and Washington, and Independence mines made a combined yield of $46,656 in gold. At Michigan Bluff $11,172 was obtained from the following mines: Devil Basin, Big Gun, Bigelow, Bird, Blue Eyes, Bogus Thunder, Sierra Nevada, and Weske Consolidated. At Last Chance $33,008 in gold was obtained from the following mines: Frankmont, Morning Star leases, Park & Brown, Pacific Slab Consolidated, and Placer Gravel. Placer mines were also productive at Auburn, Blue Canyon, Butcher Ranch, Colfax, East Auburn, Emigrant Gap, Lincoln, Loomis, Towle, Westville, and Yankee Jims. The most productive gravel mine in the county was the Hidden Treasure drift mine at Bullion.

The most productive quartz mine in the county was the Rawhide, at Towle. The few quartz mines near Auburn produced $9,096 in gold altogether. Deep productive mines were also reported at Butcher Ranch, Colfax, Donner, Forest Hill, Gold Run, Iowa Hill, Last Chance, Newcastle, Ophir, and Westville. Pocket mines at Forest Hill produced $3,825 gold from about 4 tons of ore.

PLUMAS COUNTY.

The total yield from the mines in Plumas County in 1909 was valued at $158,078, as compared with $258,297 in 1908. The gold production was 7,618.63 fine ounces, valued at $157,491, and the silver, 1,130 ounces, valued at $587. There were 27,795 tons of siliceous ore treated at the mills, which yielded 5,114.55 fine ounces of gold, valued at $105,727, and 820 ounces of silver, valued at $426. The placer mines yielded 2,504.08 fine ounces of gold, valued at $51,764, and 310 ounces of silver, valued at $161. There were 14 producing deep gold mines and 40 placers. Of the latter, 1 hydraulic mine yielded $2,000, 6 drift mines yielded $9,718, and 33 surface or sluicing mines made a combined yield of $40,046. There was a material falling off in yield of the hydraulic and surface mines in 1909, but some increase was shown in the output of the drift mines.

Deep mining was mainly in the Johnsville district, where the output was 22,966 tons of ore, yielding $80,518 in gold, and $307 in silver, a total of $80,825, from the Gruss, Four Hills, Johnson-Graham, Jamison, and a few other small mines. The most productive mine in the county was that of the Jamison Mining Company, at Johnsville, and the next in rank was the White Lily mine of the Seneca Mining Company, at Seneca. There are several producing deep mines at Quincy, but none of those made any notable output in 1909. Deep mines were also productive at Buck and Greenville.

The productive placers at Belden were the Long Bar, Indian Hill, French Bar, and Oak Flat; and at Buck, the Greenblower and the New York. At Clio the Brown Bear, Mountain Slide, and Haskell Peak were productive, as were the Cadmus, at Crescent Mills, and the Illinois, at Cromberg. In Eclipse district $6,487 in gold was derived from Bird Creek, Bonnie Hydraulic, Golden Gate and Mary, McMartin tailings, and No. 1, and No. 1 Extension mines. The district around La Porte was the most productive placer field, the yield for 1909 having been $25,443 in gold from the Ophir, French, Menifee, Robert Creek tailings, and Secret Diggings properties. At Meadow Valley the productive placers were those of the Gold Mountain Hydraulic and Dredging Company and the Granite Cape Nos. 1 and 2; and at Nelson Point the producers were the Castle Rock, Mormon Bar, Blue Gravel Consolidated, and Willow Creek mines. The yield for the year from the mines around Quincy was not large, though the following mines were operating: Empire Consolidated, Golden Rule, Messer, Western Star, Schley, and Santa Cruz. At Seneca the Cameron, Mountain Blow, Independent, and Yankee Bar claims were all producing. In this county the Elizabeth Consolidated, and the Great Divide were also among the productive placers.

SACRAMENTO COUNTY.

Mine production in Sacramento County, Cal., in 1908 and 1909.

Year.	Gold.		Silver.		Total.
	Quantity.	Value.	Quantity.	Value.	
	Fine ozs.		*Fine ozs.*		
1908	56,407.91	$1,166,055	3,058	$1,621	$1,167,676
1909	80,777.25	1,669,814	5,492	2,856	1,672,670
Increase	24,369.34	503,759	2,434	1,235	504,994

The increase in gold output of Sacramento for 1909—$503,759—was larger than that of any other county in the State. The dredging output increased by $424,940, the drift mine output by $62,878, and the surface placer yield by $16,510. No hydraulic mine yield was reported in 1909, though $569 in gold was obtained from that source in 1908. There were 8 dredges operating in 1909 and 1 drift mine, with 3 surface placers. No deep mines were worked. The 2 dredging companies operating in the Folsom and Natoma division, near the towns of Fair Oaks and Folsom, were the Natomas Consolidated of California and the Ashburton Mining Company. During the year 1909 the 7 dredges of the Natomas Consolidated of California turned over 321.48 acres and handled 13,975,185 cubic yards of auriferous gravel at a cost of 3.6 cents per cubic yard, while digging to an average depth of 27 feet on ground ranging from 19 to 70 feet deep.

SAN BERNARDINO COUNTY.

In 1909 San Bernardino County produced 1,938.43 fine ounces of gold, valued at $40,071; 24,173 ounces of silver, valued at $12,570; 148,312 pounds of copper, valued at $19,280; and 11,366 pounds of lead, valued at $489, a total value of $72,410. The total yield showed a decrease in value of $175,383 in 1909. The main decrease was $140,440 in gold, but the silver value was also $23,134 less, the copper $7,383 less, and the lead $4,426 less than in 1908. In 1908 there were 48 producing mines and in 1909 there were 35. The principal cause for the falling off in yield in 1909 was, however, the lessened yield of the more prominent mines. There were 19 producing deep gold mines, 9 silver and silver-gold mines, 6 copper mines, and 1 silver-lead mine. The output was 4,449 tons of ore in 1909, as compared with 25,182 tons in 1908, a reduction of 20,633 tons, which sufficiently accounts for the notable reduction in total yield of metals for the year.

The most productive property in the county in 1909 was the Camp Rochester mine of the Bagdad-Chase Mining Company, at Stagg, where the greatest values were in copper. Next in order was the Supply mine of the Seal of Gold Mining Company, at Dale, where the greatest value was in gold. The third in order of production was the Standard Mines Company, at Cima, where most of the value was in copper. No other mines in the county reached a total value in output as high as $10,000. Other productive mines were at Amboy, Barstow, Cima, Barnwell, Daggett, Dale, Danby, Hart, Halleck, Needles, Stagg, and Victorville. There were no productive placers in the county in 1909.

SHASTA COUNTY.

Mine production of Shasta County, Cal., in 1908 and 1909.

Year.	Gold.		Silver.		Copper.		Total.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
	Fine ounces.		*Fine ounces.*		*Pounds.*		
1908	54,752.37	$1,131,832	976,596	$517,596	33,852,842	$4,468,575	$6,118,003
1909	77,423.66	1,600,489	1,414,346	735,460	50,013,511	6,501,757	8,837,706
Increase	22,671.29	468,657	437,750	217,864	16,160,669	2,033,182	2,719,703

Shasta County is not only the most productive county in metallic output in the State, but it showed a much larger increase in 1909 than any of the other counties. This was mainly due to the operation of the large copper companies and their smelting plants. The county was the largest producer in the State of both copper and silver, and ranked also among those which produced over $1,000,000 in gold in 1909, ranking fifth among the gold-producing counties. Not only were there several very productive gold mines in the county, but large quantities of auriferous ore were purchased by the copper-smelting companies to be used as flux with their copper ores.

The total number of deep mines from which product was reported in 1909 was 34, of which 28 were deep gold, 2 silver and silver-gold, and 4 copper mines.

The yield was the largest ever made by Shasta County, and showed great increases in copper, gold, and silver.

The tonnage of the county was the largest in the State, being altogether 854,256 tons, of which 723,722 tons were copper ores and 130,534 tons were siliceous ore. The yield from this ore is given in the preceding table.

From the deep mines of the county in 1909 were obtained 75,902.17 fine ounces of gold, valued at $1,569,037, and from the placers 1,521.49 ounces, valued at $31,452. These placers included 2 dredges and 7 sluicing mines. The deep mines yielded 1,414,096 ounces of silver, valued at $735,330, and the placers 250 ounces, valued at $130.

The gold obtained from siliceous ores was 47,531.68 fine ounces, valued at $982,567, and that derived from copper ores was 28,370.49 fine ounces, valued at $586,470. The silver from siliceous ores was 27,279 ounces, valued at $14,185, and the silver from copper ores was 1,386,817 ounces, valued at $721,145. The siliceous ore yielded, therefore, $996,752 in gold and silver, and the copper ore yielded $1,307,615, a total of $2,304,367 in gold and silver from the deep mines.

Gold and silver mills in 1909 in Shasta County treated 39,767 tons of ore, which yielded in gold in bullion $571,195, an average value of $14.36 per ton, and in silver in bullion, $2,369, an average value of $0.06 per ton. The total recovery on plates was $573,564, an average in gold and silver of $14.42 per ton.

This ore, together with 10 tons sent to concentrating mills, produced 185 tons of concentrates, with a gold value of $27,743 and a silver value of $114, making the total value of the concentrates $27,857. The average value per ton of the concentrates was $149.96 in gold and $0.62 in silver, a total average value of $150.58 per ton.

The total gold value of the ore treated at gold and silver mills and that treated at concentrating mills was $598,938, an average of $15.06 per ton, and the total silver value was $2,483, or $0.06 per ton, a total gold and silver recovery from the plates and from the concentrates of $601,421, or an average recovery of $15.22 per ton.

The crude ore sent to smelters, amounting to 812,775 tons, produced (in addition to the copper) $966,419 in gold, an average of $1.19 per ton, and $732,713 in silver, or $0.90 per ton. The total gold and silver value of the ore sent to smelters was $1,699,132, or an average value of $2.09 per ton.

There were treated in the county 1,704 tons of old tailings in 1909, which yielded $3,680 in gold and $134 in silver, a total of $3,814.

The most productive gold mine in the county was the Gladstone, at French Gulch, owned by the Hazel Mining Company. Other large gold producers in order of rank were the Midas Mining Company, at Harrison Gulch (Knob P. O.), Reid Mining Company, at Whitehouse, and the Original Quartz Hill mine, at Buckeye. The most productive operator in the county and in the State in total output of metals was the Mammoth Copper Company of Maine, at Kennett. In addition to this, the other large copper and gold producers were the Balaklala Consolidated Copper Company, at Coram, the Bully Hill Copper Mining and Smelting Company, at Winthrop, and the Mountain Copper Company, at Keswick. The largest number of mines at any one place is at French Gulch, where the mines produced 27,110 tons of ore, yielding $418,622 in gold and $1,709 in silver. These mines were the Black Sentinel, Niagara, Brunswick, Blagrave, Empire, El Dorado, Gladstone, Summit Gulch, Summit, Washington, Tom Green, and Milkmaid. There were several small quartz producers at Bayles, Buckeye, Igo, and Gas Point, and other deep mines were worked at Keswick, Kennett, Larkin, Stella, Shasta, and Whitehouse.

The placer mine output from 2 dredges and 7 sluicing mines is included in the table of source of placer gold, with Merced and Stanislaus counties, in order to combine the yield of 4 dredges and other placers and not make public individual outputs.

SIERRA COUNTY.

The total production of Sierra County in 1909 was valued at $190,629, as compared with $414,543 in 1908, a decrease of $223,914. The main decrease was in gold, this being $222,954 less than the yield of 1908, which was the largest decrease in 1909 among the counties of the State. The yield of the county in 1909 was 9,175.38 fine ounces of gold, valued at $189,672, and 1,841 ounces of silver, valued at $957. There were 17,766 tons of siliceous ore treated in Sierra County in 1909, yielding 4,176.69 fine ounces of gold, valued at $86,340, and 1,233 ounces of silver, valued at $641. The gold derived from placers amounted to 4,998.69 fine ounces, valued at $103,332, and there was also produced 608 ounces of silver, valued at $316. Of this placer gold $47,538 was derived from 11 hydraulic mines, $21,686 from 12 drift mines, and $34,108 from 16 surface or sluicing mines, there being 39 producing placers in all. There were 20 productive deep gold mines. The placers of the county were more productive than the quartz mines in 1909—a reverse of the conditions in 1908.

The marked reduction of yield of this county in 1909 is the cause of some surprise, inasmuch as extensive development and exploration work has been carried on there in the last few years, and some rich discoveries have been made. However, an analysis of figures of the two years easily reveals the cause to be the material falling off in output of all the more prominent quartz mines. For example, the deep mines at Alleghany in 1909 only produced 1,514 tons of ore, yielding $41,379, whereas in 1908 the output of that district in ore was 13,626 tons of ore, yielding $173,866. At Sierra City in 1909 there were produced 14,185 tons of ore, yielding $25,037 in gold. In

1908 this district produced 62,500 tons of ore, yielding $123,781 in gold. At this place the Alta Sierra, or Keystone lease, which was a large producer in 1908, was idle in 1909, and the other mines reduced their output materially. At Alleghany litigation caused partial stoppage of work in the largest producer, and the second largest producer of 1908 did mainly development work in 1909 and made only a nominal output. At Downieville, where there was a smaller tonnage in 1909 than in 1908, there was a larger yield, owing to the higher grade of ore worked.

There was only a slight falling off in placer gold yield, the total in 1909 having been $103,332, against $109,631 in 1908.

The deep-mine producers at Alleghany district in 1909 were the Eastern and Western Cross, El Dorado, Gold Canyon, Morning Glory, Rainbow, Red Star, Plumbago, and the Tightner Consolidated, the latter being the largest deep producer in the county. At Downieville the Gray Eagle, Standard, and Willoughby were the producers, and at Sierra City the deep producers were the Cleveland, Primrose, Sierra Buttes, and Chipps.

The largest producers among the placer mines were the Depot Hill hydraulic, near Camptonville; the Indian Hill, at the same place; the Ninety-Nine and the Quen Fat hydraulic mine, run by Chinese operators, at Table Rock; the Telegraph Hill drift, at Downieville; and the Neocene Placer, at Scales. The largest output in gold from any mine in the county, deep or placer, was derived from the Bellevue drift mine, at Gibsonville. Other placers were worked productively at Forest, Pike, Port Wine, and St. Louis.

SISKIYOU COUNTY.

In 1909 Siskiyou County produced 20,131.74 fine ounces of gold, valued at $416,160, and 4,125 ounces of silver, valued at $2,145, a total of $418,305, as compared with $511,073 in 1908. A small quantity of copper was produced in 1908, but none in 1909. The main decrease was in the value of gold production, which was $87,996 less in 1909 than in 1908. The 48 deep gold mines of the county yielded from 19,009 tons of ore 9,055.12 fine ounces of gold, valued at $187,186, and 2,025 ounces of silver, valued at $1,053, a total of $188,239. The 107 producing placers yielded 11,076.62 fine ounces of gold, valued at $228,974, and 2,100 ounces of silver, valued at $1,092, a total of $230,066. The placer mines thus yielded $41,827 more than the deep mines in Siskiyou County in 1909. There were 155 productive mines in the county in 1909, which was 61 more than in any other county in the State. Of the placers, 52 hydraulic mines produced $113,304 in gold, 3 dredges produced $49,223, 3 drift mines $2,234, and 49 surface or sluicing mines $64,213.

There were 33 more producing placers in Siskiyou County in 1909 than in any other county in the State. Most of the placers, however, are comparatively small. There are no restrictions against hydraulic mining in this county, as there are in the central counties of the State, none of the rivers being navigable or liable to damage from mining débris.

Of the deep-mine operators, the Mono Mining Company, of Yreka, was the most productive in the county. Other deep mines of notable yield were the Highland, at Etna Mills; McKean, at Callahan; Patterson Creek (Sheba), at Fort Jones; Little Queen, at Greenview;

Elk Creek (Providence), at Hawkinsville; California, at Sawyer's Bar; and Lucky Bob, at Snowden. The Adeline Ricks, Eaton, and McKean mines at Callahan made a combined product of 2,400 tons of ore, yielding $13,188 in gold. At Etna Mills the Advance, Hardscrabble, Finley & Johnson, Hoodoo, Highland, Lucky Strike, and Czarina produced 1,811 tons of ore, yielding $47,663 in gold. In the Fort Jones district the Orphan and Last Chance, "Get There," Golden Eagle, and Patterson Creek (Sheba) mines made a combined output of 5,286 tons of ore, yielding $23,719 in gold. In Hawkinsville district the Providence, Easter, Gipsey, Granite Crosscut, and Red Hill mines produced 303 tons of ore, yielding $9,376 in gold. Around Yreka the Black Hawk, Eliza, Inyo, Mono, and Dividend (Mount Vernon) mines made a combined product of 5,448 tons of ore, yielding $46,388 in gold. Other deep mines were worked productively at Cecilville, Gilta, Gottville, Greenview, Hornbrook, Hilt, Oak Bar, Oro Fino, Sawyer's Bar, Scott Bar, Seiad Valley, Snowden, and Walker.

Of the placers the largest producers were the Scott River Dredging Company, at Callahan, and the Bloomer hydraulic mine at Forks of Salmon. Other notable placer producers were the Summerville hydraulic mine, at Cecilville; Northern California Mining Company (dredge), at Gottville; Nordheimer hydraulic and Sauerkraut hydraulic, at Forks of Salmon; Fernandez, at Fort Jones; Weed & Gardner sluicing mine, at Greenview; Free Trade and Myers hydraulic, Younger hydraulic, and Quartz Hill hydraulic, at Sawyer's Bar; and Seiad Mining Company's hydraulic mine, at Seiad Valley.

Of the principal placer districts of the county the Callahan district produced $45,154 in gold; Forks of Salmon district, $32,747; Fort Jones, $10,092; Hamburg, $9,946; Happy Camp, $3,918; Hawkinsville, $5,141; Oak Bar, $6,509; Sawyer's Bar, $25,072; Seiad Valley, $6,059; Scott Bar, $14,670; Walker, $3,050; and Yreka, $9,024. Placer mines were also worked productively in 1909 at Black Bear, Cecilville, Gottville, Gazelle, Gilta, Greenview, Hilt, Hutton, Nolton, Oro Fino, Rollin, and Somesbar.

TRINITY COUNTY.

In 1909 Trinity County produced 25,157.22 fine ounces in gold, valued at $520,046, and 4,427 ounces of silver, valued at $2,302, a total of $522,348, which was a decrease in value of $84,865, of which the decrease in gold yield was $82,898. There were 34 productive deep mines of the county in 1909, with an output of 9,882 tons of ore, as compared with 24 deep mines in 1908, with 20,796 tons of ore, there being 10 more mines in 1909, but a decrease of 10,914 tons of ore. The yield from the ore in 1909 was 7,342.45 fine ounces of gold, valued at $151,782, and 2,144 ounces of silver, valued at $1,115, a total value of $152,897. The 55 placers yielded 17,814.77 fine ounces of gold, valued at $368,264, and 2,283 ounces of silver, valued at $1,187, a total of $369,451. The 42 hydraulic mines yielded $357,672 in gold, 1 drift mine yielded $101, and 12 surface or sluicing mines yielded $10,491 in gold. In hydraulic mining output Trinity far exceeds any other county of the State, there being no legal restrictions in the county to compel impounding of the débris, as in most other counties of California. The largest and most productive hydraulic mine in the United States, the La Grange, is in Trinity County.

The principal deep-mine producers of the county are the Globe, at Dedrick; Brown Bear, at Deadwood; Mountain Boomer, at Denny; Surprise and Five Pines, at Trinity Center; Blue Jay, at Lewiston; Trinity-Bonanza King, at Trinity Center; Dorleska, at Dorleska; and Bullychoop, at Douglas City.

The productive deep mines at Carrville are the Golden Jubilee, New Blue Jay, and Oro Grande. In Coffee district the Gold Ridge, Clipper, Parker Gulch, Three Peaks, and Flower of Eardath produced 216 tons of ore, yielding $3,133 in gold. In the Deadwood district 2,415 tons of ore were produced, yielding $31,094 in gold, by the Amy Balch, Goodyear & Richards, Brown Bear, Jacoby, Calwick (Lappin), Venecia, and West Point mines. At Dedrick the Globe mines and the Ralston group were productive, and at Denny the Buckeye and the Mountain Boomer. At Douglas City the Bullychoop, Dixie Queen, Oriole, and Texas Jack mines produced 1,105 tons of ore, yielding $6,423 in gold. The Grizzly, Jolly Rose, and Mountain View mines are at Helena. The Daisy and Blue Jay are at Lewiston, and the Bonanza and Fairview mines are at Minersville.

Of the placers of the county, by far the most productive was the La Grange hydraulic mine, near Weaverville. Other notable hydraulic mine producers in the county are the Hupp, at Weaverville; Trinity, at Minersville; Sykes, at Trinity Center; and Unionville hydraulic, at Douglas City. The Don Juan Point, Fortune Teller, and Vance Bar, at Big Bar, made an output of $3,453 in gold. At Burnt Ranch, Carrville, Coffee, Dedrick, Denny, and Dorleska the mines made small outputs. In Douglas City district the Dry, Indian Creek hydraulic, Steiner's Flat, Spring Gulch, and Union Hill mines made a combined yield of $42,935 in gold. The Hayfork and the Helena district mines made small outputs only. At Junction City, $15,382 in gold was obtained by the following mines: Berger, Chapman, Cummings, Dolly Varden, Dannenbrink, Evans Bar, Haas, Gold Dollar, Maple Creek, Post, and Jacobs. At Lewiston, $4,137 was produced by the Adele, China Bar, and Eastman Gulch mines. Besides the Trinity were the Butler hydraulic and the Cement and Mule Creek producing placers at Minersville. At Quinby are the small placers of the New River Mining Company and the Panther Creek Bar, and at Trinity Center the hydraulic mines of the Buckeye and the Sykes Mining Company. Omitting the output of the La Grange hydraulic mine, the sum of $35,191 in gold was obtained by the following mines combined at Weaverville: Homestake and Ellerbrook Consolidated, Lucky Strike and Effie Belle, Hupp, Meckel Bros., and Sydney Hill.

TUOLUMNE COUNTY.

Mine production of Tuolumne County, Cal., 1908 and 1909.

Year.	Gold.		Silver.		Total.
	Quantity.	Value.	Quantity.	Value.	
	Fine ounces.		*Fine ounces.*		
1908	38,639.63	$798,752	22,136	$11,732	$810,484
1909	44,780.88	925,703	8,430	4,384	930,087
Increase (+) or decrease (−)	+6,141.25	+126,951	−13,706	−7,348	+119,603

Tuolumne County increased its gold output in 1909 above that of 1908, but the yield of silver decreased. In 1909 the county mines produced 44,780.88 fine ounces of gold, valued at $925,703, and 8,430 ounces of silver, valued at $4,384, a total of $930,087. There were 48 deep producing mines in the county, all gold, and 5 placers, of which 1 was a hydraulic mine, 3 were drift mines, and 1 a surface placer. The combined production of these placers in gold in 1909 was $5,864.

The total tonnage output of the county in 1909 was 288,618 tons of ore, of which 9 tons were sent to smelters, 2,328 tons were treated in mills for concentrating only, and the remainder was treated in gold and silver mills. The 286,281 tons treated at gold and silver mills yielded in bullion $523,858 in gold, an average of $1.83 per ton, and $3,710 in silver, or an average of a little more than 1 cent per ton, or a total saved on the plates of $527,568, an average of $1.84 per ton in gold and silver.

From this milling ore and the ore to concentrating mills 10,878 tons of concentrates were obtained, which yielded $391,131 in gold, an average of $35.95 per ton, and $633 in silver, an average of $0.06 per ton, or a total of $391,764 in gold and silver, and an average yield of $36.01 per ton.

The ore milled and concentrated yielded a total of $914,989 in gold, or an average of $3.16 per ton, and $4,343 in silver, or $0.02 per ton. The total yield of gold and silver on the plates and from concentrates was $919,332, or an average yield of $3.18 per ton.

The 9 tons of ore shipped to the smelter yielded $4,850 in gold and $21 in silver, a total of $4,871.

At Columbia the deep mines produced 945 tons of ore, yielding $21,214 in gold and $96 in silver. These were the Brown, Ethel, Experimental Gulch, Lynn, Over, Oregon, and Riverside mines. At Big Oak Flat district 11,142 tons of ore were produced, yielding $29,008 gold and $261 silver from the following mines: Mack, Grizzly, Poco Tiempo, Champion Nos. 1 and 2, Leithold, International (Nonpareil), and Ophir. In Jamestown district the Alabama, Central Mother Lode, Harvard mines, Karnac, and Texomega (Omega) mines combined produced 92,378 tons of ore, yielding $226,083 in gold and $822 in silver. The pocket mines around Sonora, from a few tons of ore, yielded $41,624 in gold and $153 in silver. At Tuolumne City 3,604 tons of ore were produced, yielding $24,732 gold and $202 silver from the following mines: Blue Lead, Parlin, Dave, Head Center, Erie, Mohican, Paymaster, and United mines. At Tuttletown the following mines and a few pocket claims produced 2,045 tons of ore, yielding $29,113 in gold and $93 in silver; Calmas (Arbona), Fuse, Gross Consolidated, Santissimo, and Wilson & Means.

Deep gold mines were also operated in 1909 at Chinese, Confidence, Quartz, Soulsbyville, and Stent. The most important deep-mine producers in the county are the App Consolidated Mining Company at Quartz, Harvard Mines at Jamestown, Eagle-Shawmut Mining Company at Chinese, Mack at Big Oak Flat, Experimental Gulch at Columbia, Bagdad-Chase Mining Company at Soulsbyville, and Mohican Mining Company at Tuolumne City.

Most of the placer mines of the county are at Columbia, but one was in operation near Jamestown.

YUBA COUNTY.

In 1909 Yuba County produced 119,479.72 fine ounces of gold, valued at $2,469,865, and 7,992 ounces of silver, valued at $4,156, a total of $2,474,021, as compared with $2,004,483 in gold and silver in 1908. The increase in value of gold for the year was $435,379, which was entirely due to increased yield of the placers, the deep mines having produced $22,181 less gold in 1909 than in 1908.

The deep mines of the county produced 1,873 tons of siliceous ore in 1909, yielding $13,760 in gold and $67 in silver. These mines are the Northern, at Brownsville; Bessie and Smithurst, at Browns Valley; Eagle, Conwell, Good Title, and Red Cross, at Dobbins; Santa Rosa, at Rackerby; Eagleville, at Strawberry Valley; and Arbucca, at Woodleaf.

Of the 26 placer mines in operation, 15 were dredges, 10 were surface or sluicing, and 1 was hydraulic. The gold yield from dredging operations was $2,441,919, from surface mines $12,527, and from hydraulic operations $1,659. These surface and hydraulic placers are mainly at Brownsville, Browns Valley, and Camptonville; and the dredging operations were in the vicinity of Marysville, with the exception of one dredge on Bear River. There are three dredging companies operating in the county. The dredging field near Marysville is now considered to be the most extensive in the State, although that at Oroville exceeded it in output of gold in 1909. Machines of the largest capacity and of the most substantial type are in use in the Marysville field and more new ones are being added yearly. The output of gold from dredging operations in this county in 1909 was $2,441,919, as compared with $1,969,079 in 1908, the increase being therefore $472,840 for the year 1909.

OTHER COUNTIES.

Colusa, Lassen, and Modoc counties.—These three counties are combined in this chapter for the reason that there was but one productive mine in each in 1909. These were the Manzanita, at Sulphur Creek, Colusa County, the Lassen, at Hayden Hill, Lassen County, and the Hess, at Adin, Modoc County. Their combined output in 1909 was 5,627.32 fine ounces of gold, valued at $116,327, and 2,813 ounces of silver, valued at $1,463, a total of $117,790 from 17,389 tons of ore.

Imperial and San Diego counties.—Imperial and San Diego are adjoining counties in the extreme southern portion of the State. The total yield of Imperial County in 1909 was 2,888.23 fine ounces of gold, valued at $59,705, and 1,007 ounces of silver, valued at $524, and 280 pounds of copper, valued at $36. The total value of the metal yield of the county was $60,265, an increase for 1909 of $53,714. The few deep mines in operation were at Ogilby and Picacho, and the larger part of the output was derived from the operations of the Picacho Basin Mining Company at Picacho. A few small placers were worked in the vicinity of Picacho. There were only six productive mines in the county in 1909. The total output of San Diego County in 1909 was 619.78 fine ounces of gold, valued at $12,812, and 3,310 ounces of silver, valued at $1,721, a total of $14,533, and an increase of $7,527 in 1909. There were

10 deep gold mines, producing in the county in 1909, and their entire output was 1,707 tons of ore. These mines were the Cleveland-Pacific at Escondido; the Bailey & McLean, "O. K.," Venturina, and Ready Relief, at Banner; the Boulder Creek, at Lakeside; and the Eagle, Julian Consolidated, Owens and Old Owens, and Warlock, at Julian.

Los Angeles and Riverside counties.—Los Angeles and Riverside are contiguous counties in the southern portion of the State. In Los Angeles there were 3 deep gold mines at Neenach, Shoemaker, and Lebec, productive in 1909, with a combined output of 96 tons of ore, yielding $864 in gold and $2 in silver, a total of $866. Riverside County reported 2 copper mines in operation at Blythe in 1908, which yielded from 32 tons of ore $186 in gold, $24 in silver, and 16,117 pounds in copper, valued at $2,095, a total value for the year of $2,305.

Monterey County.—Monterey County made the nominal output of $333 in gold, and $5 in silver, from a few small placers at Jolon, no deep mines having been productive.

Madera, Merced, and Stanislaus counties.—These are three adjoining counties in the center of the State. The combined output of gold of the three counties in 1909 was 11,765.19 fine ounces of gold, valued at $243,208, and 1,875 ounces of silver, valued at $975, a total value of $244,183. The deep mines are all in Madera County, and there are placers in all three counties. The deep mines are at Ahwahnee, Coarse Gold, Grub Gulch, Hildreth, O'Neals, and Raymond. The deep-mine gold of the three counties was $11,966; that from the auriferous gravels was $231,242. This included the yield of two dredging companies as well as of the other placers in the three counties named.

COLORADO.

By Charles W. Henderson.

PRODUCTION.

The total value of the production of gold, silver, copper, lead, and zinc in Colorado for 1909, as reported from 925 productive mines, 21 of which were placers, amounted to $33,907,140, as compared with $31,948,722 in 1908, an increase for 1909 of $1,958,418. Of the total value for 1909, nearly 65 per cent represented gold, which was valued at $21,989,336, a decrease of $311,291, as compared with the yield of 1908. There was a decrease of only 2,800 fine ounces in the quantity of silver produced, but the value of this metal for 1909, at an average price of 1 cent less per ounce than in 1908, showed a decrease of $90,510. The production of copper in Colorado, which is mainly incidental to the recovery of other metals, has shown a steady though small increase since 1906. The production of this metal for 1909 was 10,922,046 pounds, as against 9,997,738 pounds in 1908, an increase of 924,308 pounds. The quantity of lead produced in 1909 was 72,167,790 pounds, an increase of 19,967,660 pounds, due to an increased tonnage of lead ores, and an increased recovery of lead from lead-zinc ores. The quantity of zinc produced was 51,210,260 pounds, an increase of 21,080,258 pounds.

The output of ore sold or treated in 1909 from Colorado mines was 2,219,741 tons, a decrease of 24,150 tons as compared with the output in 1908.

The siliceous or dry ores amounted to 1,749,112 tons, a decrease of 81,818 tons. The average value of siliceous or dry ores per ton in gold and silver was $13.41 in 1909, as compared with $13.10 in 1908, with $14.49 in 1907, and with $14.90 in 1906.

The copper ores amounted to 60,673 tons, an increase of 48,326 tons. Lead ores amounted to 174,483 tons, an increase of 73,622 tons. Zinc ores increased from 2,583 tons in 1908 to 5,014 tons in 1909, an increase of 2,431 tons. There were 9,267 tons of copper-lead ores produced in 1909, a decrease of 48,969 tons. The output of lead-zinc ores was 221,192 tons, an apparent decrease of 17,742 tons. The combined output of lead, zinc, and lead-zinc ores showed an increase of 58,311 tons.

The average value per ton of copper ores in gold and silver was $16.32; of lead ores, $5.41; of zinc ores, $1.07; of copper-lead ores, $27.03; and of lead-zinc ores, $2.34. The average total value per ton of all the ore mined in Colorado in 1909 was $11.78, as compared with $14.16 in 1908, with $15.67 in 1907, with $16.47 in 1906, with $17.37 in 1905, and with $17.89 in 1904.

During 1909 there were treated at amalgamating, cyaniding, or chlorinating mills, with or without concentration equipment (including all the custom mills in the State), 1,320,111 tons of ore, and the bullion saved contained $13,999,145 in gold, an average per ton of $10.604, and 289,782 ounces of silver, valued at $150,687, an average per ton of 0.22 ounces or $0.114, a total value in gold and silver of $14,149,832, and a total value of $10.718 per ton, as compared with $11.04 in 1908.

From the 1,320,111 tons treated at amalgamating, cyaniding, and chlorinating mills, and from 357,658 tons sent to concentrating and separating mills, a total to both classes of mills of 1,677,769 tons (75.6 per cent of the total tonnage treated), were produced 154,091 tons of concentrates (ratio 11 to 1), from which were recovered $2,219, 238 in gold, an average value per ton of $14.40, and 2,453,274 ounces of silver, valued at $1,275,702, an average per ton of 15.92 ounces, or $8.28, a total value in gold and silver of $3,494,940, and an average of $22.68 per ton, as compared with $19.60 per ton in 1908. From these concentrates were also recovered 2,529,379 pounds of copper, valued at $328,819, averaging 0.82 per cent, or $2.13 per ton, 36,851,771 pounds of lead, valued at $1,584,626, averaging 11.96 per cent, or $10.283 per ton, and 27,036,073 pounds of zinc (in terms of spelter recovered), valued at $1,459,948, or $9.474 per ton; a total average value for the concentrates in gold, silver, copper, lead, and zinc of $44.567 per ton. There were recovered from the 1,677,769 tons to both classes of mills $16,218,383 in gold, from both bullion and concentrates, or an average recovery per ton of $9.67, and $1,426,389 in silver, or an average per ton of $0.85, a total in gold and silver of $17,644,772, and an average per ton of $10.52 for all ore milled, as compared with $10.82 per ton in 1908. There was one mill at Colorado City which re-treated tailings from previous years, the recovery of which can not be disclosed.

Crude ore shipped to all kinds of smelters amounted to 541,972 tons, from which was recovered $5,257,186 in gold, averaging $9.70 per ton;

6,153,777 ounces of silver, valued at $3,199,964, averaging 11.35 ounces, or $5.904 per ton, a total in gold and silver of $8,457,150, and an average of $15.60 per ton, as compared with $14.86 per ton in 1908; crude ore also contained 8,392,668 pounds of copper, valued at $1,091,047, averaging 0.77 per cent, or $2.013 per ton; 35,316,024 pounds of lead, valued at $1,518,589, averaging 3.26 per cent, or $2.801 per ton; and 24,174,187 pounds of zinc, valued at $1,305,406, averaging $2.408 per ton; a total value for crude ore shipped to smelters of $22.83 per ton.

Crude ore and concentrates to smelters therefore amounted to 696,063 tons, from which were recovered $7,476,424 in gold, $4,475,666 in silver, 10,922,046 pounds of copper, 72,167,790 pounds of lead, and 51,210,260 pounds of zinc, with a total value of $19,240,525. Therefore the smelters treated 31 per cent of the tonnage mined, and recovered 34.7 per cent of the gold, 96.7 per cent of the silver and all the copper, lead, and zinc, and 58 per cent of the total value of deep-mine output.

There were 21 productive placers in 1909 in Colorado, which yielded $458,492 in gold and $3,016 in silver, a total of $461,508 in gold and silver, as compared with $186,058 in 1908.

The statement of Colorado production for 1908 and 1909, showing increase or decrease, and value at each year's commercial price, is as follows:

Mine production of gold, silver, and associated metals in Colorado in 1908 and 1909.

Metal.		1908.		1909.		Increase (+) or decrease (−).	
		Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold	fine ounces	1,078,792.83	$22,300,627	1,063,734.13	$21,989,336	− 15,058.70	− $311,291
Silver	do	8,905,433	4,719,879	8,902,633	4,629,369	− 2,800	− 90,510
Copper	pounds	9,997,738	1,319,701	10,922,046	1,419,866	+ 924,308	+ 100,165
Lead	do	52,200,130	2,192,405	72,167,790	3,103,215	+ 19,967,660	+ 910,810
Zinc	do	30,130,002	1,416,110	51,210,260	2,765,354	+ 21,080,258	+ 1,349,244
Total			31,948,722		33,907,140		+ 1,958,418

GOLD.

The total gold production for Colorado in 1909 amounted to 1,063,734.13 fine ounces, valued at $21,989,336, as against 1,078,792.83 fine ounces, valued at $22,300,627 in 1908, a decrease of 15,058.70 fine ounces in quantity and of $311,291 in value.

The Cripple Creek district, with a decrease of $1,269,614, produced $11,470,673 in gold, which was 52 per cent of the gold output from all sources and 53 per cent of the gold from deep mines. Operators of several of the large properties in Cripple Creek curtailed their operations and waited for the mines to be unwatered by the drainage tunnel.

Besides Teller County, the notable decreases in gold production were in Clear Creek, Gilpin, and San Juan counties, with less marked decreases from Chaffee, Eagle, Mineral, and San Miguel counties. The increase of $1,016,127 from Ouray County, of $206,982 from Lake County, of $265,825 from Summit County, and of $121,113 from Park County did much to maintain the gold output of the

State. There were also small but notable increases in the output of Boulder, Custer, Gunnison, Hindsdale, and La Plata counties.

Siliceous and dry ores, which made 79 per cent of all the tonnage mined, yielded 990,624.45 fine ounces of gold, valued at $20,478,025, or 93 per cent of all the gold production. A little less than 2 per cent of the gold came from lead ores, 2 per cent from copper ores, and less than 1 per cent from lead-zinc ores. A little over 2 per cent came from placers. The rest was from copper-lead and zinc ores.

Placer gold in 1909 amounted to 22,179.54 fine ounces, valued at $458,492, an increase of $273,557. Summit County, with 4 dredges and 1 small drift mine, produced over 88 per cent of the placer yield. Hydraulic mines in Chaffee and Park counties made up nearly all the remainder. Small yields were reported from Clear Creek, Eagle, Grand, Lake, Routt, and San Miguel counties.

Source of gold in Colorado in 1909 by kinds of ore, by counties, in fine ounces.

County.	Placers.	Deep mines.						Total.
		Siliceous or dry ores.	Copper ores.	Lead ores.	Zinc ores.	Copper-lead ores.	Lead-zinc ores.	
Boulder		7,752.76	92.00	53.57				7,898.33
Chaffee	942.35	54.81	53.37	109.67		17.05	297.46	1,474.71
Clear Creek	186.05	24,269.64	304.13	305.79			883.08	25,948.69
Custer		614.35		3.59				617.94
Dolores		563.37	.06	36.16		4.42	473.11	1,077.12
Eagle	54.23	1,544.20	818.16	.42			161.76	2,578.77
Fremont, Grand, Jefferson, and Montezuma	57.23	4.94	4.11					66.28
Gilpin		37,008.82	4,813.44	1,101.41				42,923.67
Gunnison		5,203.00	1.02	32.46		1.80	10.07	5,248.35
Hinsdale		171.37	.27			195.38		367.02
Lake	13.83	42,589.97	14,504.17	11,218.99		273.91	838.10	69,438.97
La Plata		6,145.09		4.29				6,149.38
Larimer								
Mineral		914.09		242.32			4,108.00	5,264.41
Ouray		145,777.97	459.52	64.30		989.47	2.15	147,293.41
Park	1,178.32	25,274.10		7.02	31.38	1.47	206.89	26,699.18
Pitkin		36.04						36.04
Routt	116.97	45.62						162.59
Saguache		55.44		2.26		.15		57.85
San Juan		28,564.41	152.78	3,673.77		662.08		33,053.04
San Miguel	21.28	107,988.86	11.44	184.91		2,332.85		110,539.34
Summit	19,609.29	1,151.79		253.91	3.61		883.96	21,902.56
Teller		554,893.81						554,893.81
Unapportioned			41.65	1.02				42.67
Total	22,179.55	990,624.45	21,256.12	17,295.86	34.99	4,478.58	7,864.58	1,063,734.13

SILVER.

The silver yield in 1909 amounted to 8,902,633 ounces, valued at $4,629,369, as against 8,905,433 ounces in 1908, valued at $4,719,879, a decrease of 2,800 ounces in quantity and of $90,510 in value.

Lake County, which produced 32 per cent of the silver yield in 1908, made an increase of over 500,000 ounces, and the output was 38 per cent of the state yield in 1909. There was a material increase from Mineral County. Pitkin County's yield fell off 341,662 ounces, and the output from San Juan and San Miguel counties showed considerable decrease. The output from Clear Creek, Dolores, Gilpin, and Ouray counties also decreased. Boulder, Eagle, Gunnison, Hinsdale, Park, and Summit counties made a notable increase in the aggregate.

In the production of silver 7 counties, in the order named, Lake, San Miguel, Mineral, San Juan, Pitkin, Clear Creek, and Ouray, furnished 89 per cent of the total.

Siliceous or dry ores yielded 5,716,373 ounces, or 64.2 per cent of the silver output; lead ores, 1,127,589 ounces, or 12.7 per cent; lead-zinc ores, 681,445 ounces, or 7.7 per cent; copper-lead ores, 303,631 ounces, or 3.6 per cent; copper ores, 1,058,894 ounces, or 11.9 per cent; and zinc ores, 8,901 ounces, or negligible per cent.

Source of silver product in Colorado in 1909 by kinds of ore, by counties, in fine ounces.

County.	Placers.	Deep mines.						Total.
		Siliceous or dry ores.	Copper ores.	Lead ores.	Zinc ores.	Copper-lead ores.	Lead-zinc ores.	
Boulder		44,784	1,420	1,979				48,183
Chaffee	156	664	7,447	4,894		260	22,056	35,477
Clear Creek	29	264,333	7,639	91,052			85,482	448,535
Custer		8,468		6,328				14,796
Dolores		39,303	1	8,501		1,100	54,741	103,646
Eagle	4	40,653	66,352	7,150			11,055	125,214
Fremont, Grand, Jefferson, and Montezuma	9	8						17
Gilpin		140,158	18,253	13,599				172,010
Gunnison		16,582	15	3,880		4,640	12,306	37,423
Hinsdale		16,830	360			58,541		75,731
Lake	2	2,053,669	824,158	271,892		12,129	261,792	3,423,642
La Plata		73,523		629				74,152
Larimer								
Mineral		795,852		1,491			93,842	891,185
Ouray		295,955	6,325	4,704		33,683	5,148	345,815
Park	240	22,075		1,809	591	745	76,915	102,375
Pitkin		214,051		485,987				700,038
Routt	29	3,417						3,446
Saguache		56		2,115		89		2,260
San Juan		315,471	125,058	130,349		172,759		793,637
San Miguel	4	1,288,903	866	34,694		19,685		1,344,152
Summit	5,327	21,601		6,417	8,310		58,108	99,763
Teller		60,017						60,017
Unapportioned			1,000	119				1,119
Total	5,800	5,716,373	1,058,894	1,127,589	8,901	303,631	681,445	8,902,633

COPPER.

The copper output increased in quantity from 9,997,738 pounds to 10,922,046 pounds and in value from $1,319,701 to $1,419,866. Copper was reported from 20 counties in Colorado in 1909.

As usual, Lake County was the leading copper producer, yielding 47 per cent of the state output in 1909; San Juan was second, with 15 per cent of the total; Ouray, Hindsdale, Chaffee, San Miguel, Gilpin, Clear Creek, and Eagle following in order. These 9 counties produced 10,690,368 pounds, or nearly 98 per cent of the total.

LEAD.

The lead produced in Colorado in 1909 was 72,167,790 pounds, valued at $3,103,215, as against 52,200,130 pounds, valued at $2,192,405 in 1908, an increase of 19,967,660 pounds in quantity and of $910,810 in value.

In all the important lead-producing counties there were marked increases except Chaffee, Dolores, and San Miguel. The increases of particular note were from Clear Creek, Lake, Mineral, Ouray, Park, Pitkin, San Juan, and Summit counties.

In rank Lake County led, with 21,073,992 pounds; Pitkin was second, with 13,143,210 pounds; San Juan was third, with 9,085,068 pounds; Mineral was fourth, with 9,036,816 pounds, and San Miguel, Summit, Clear Creek, Ouray, Park, Gilpin, Chaffee, Gunnison, and Boulder followed in order. There was an increase of 73,622 tons in the tonnage of lead ores, an increase of 55,880 tons of the combined tonnage of lead and lead-zinc ores, and an increase of 6,911 tons of the combined tonnage of lead, copper-lead, and lead-zinc ores, as compared with the total of 1908.

ZINC.

In 1909 the marketed zinc ores from Colorado contained 51,210,260 pounds of zinc (in terms of recoverable spelter), valued at $2,765,354, as compared with 30,130,002 pounds, valued at $1,416,110, in 1908, an increase of 21,080,258 pounds in quantity and of $1,349,244 in value.

In Lake County, which produced 75.4 per cent of the state zinc output, the zinc yield increased from 23,188,080 pounds to 38,637,315 pounds, an increase of 15,449,235 pounds. The advance in zinc prices led to the sale of considerable stored zinc ores mined in 1908, and several large tonnages from dumps were treated in 1909. Increased outputs of this metal were made from Chaffee, Eagle, Gunnison, Mineral, Ouray, San Juan, and Summit counties, the last named making a marked increase of 4,566,018 pounds. Pitkin County, a prominent producer of zinc in 1907, a smaller producer in 1908, made only a few shipments of zinc ore in 1909. The output from Clear Creek fell off slightly in 1909 and that of Dolores, Park, and San Miguel considerably.

MINING INDUSTRY OF COLORADO IN 1909.

A comparison of the production of metals in Colorado in 1908 and 1909, as reported from the mines to the United States Geological Survey, shows small decreases in the output of gold and silver, a slight increase in the output of copper, and notable increases in the yield of lead and zinc for 1909.

A review of the sources of the metals shows that there was less gold bullion from deep mines in 1909, though there was a material increase of placer gold; that there was less gold and silver in concentrates marketed, but more gold and silver in crude ore marketed, the recovery of precious metals by smelters showing a slight increase from a smaller tonnage treated; that there was less silver in lead and copper-lead ores and concentrates, but a higher percentage of silver in siliceous ore; and that there was an increased tonnage of zinc and lead-zinc ore and concentrates marketed, with a resultant increased output of spelter and also a yield of silver and lead which helped to maintain the output in these metals. Much of the zinc concentrate was produced from the concentration of dry ores, with a high ratio of concentration, and as these ores are classified as siliceous or dry, the increase in tonnage of zinc-bearing ore is not wholly apparent from the tables.

In reviewing the various metallurgical processes of extracting the metals from the ores, it is found that 76 per cent of the tonnage mined was milled; that 9 per cent of this tonnage or 7 per cent of the total tonnage was the resulting tonnage in concentrates, which were treated at smelters; and that 24 per cent was sent crude to smelters, a total percentage treated by the smelters of 31 per cent of the total tonnage. It is found that from this tonnage of 31 per cent of the tonnage mined, the smelters recovered 34.7 per cent of the gold, 96.7 per cent of the silver, all the copper, lead, and zinc, or 58 per cent of the total value of metals from deep mines. It was clearly emphasized that lead and copper smelting in Colorado was marking time, there being a small increase in gold recovered by Colorado smelters, a decrease in silver, and increases in copper and lead from crude ore and concentrates and from residues from zinc smelters. Of the 15 lead or copper smelters that have been in operation in Colorado within the last ten years, 5 were in operation in 1909, and these at about one-half capacity. A new pyritic smelter was started toward the close of the year, and ran for a few months in 1910. During the year the Eilers plant at Pueblo was torn down; the Philadelphia plant, in the same city, has been dismantled for some time. The Boston and Colorado Smelting Company, at the close of 1909, informed shippers that its Argo plant would be closed some time during the first three months of 1910. This plant had been established in Black Hawk, Gilpin County, about 1872, and had been moved to Denver in 1873.

The following list gives the smelting plants in Colorado in 1909:

List of active smelting plants in Colorado in 1909.

City.	Plant.	Owner.
Denver	Globe	American Smelting and Refining Co.
Pueblo	Pueblo	Do.
Pueblo [a]	United States Zinc Co.	Do.
Leadville	Arkansas Valley	Do.
Durango	Durango	Do.
Salida		Ohio and Colorado Smelting and Refining Co.
Denver	Argo	Boston and Colorado Smelting and Refining Co.
Canon City [b]		United States Smelting Co.
Utah Junction [c]	Modern	Modern Smelting and Refining Co.

[a] Zinc-copper ores.
[b] Closed September, 1909.
[c] Started October 22, 1909.

The Eilers plant at Pueblo was dismantled in 1909.

As regards the metallurgical processes used in the mills of this State, the chlorination process has begun to give way to the cyanide process. The large mills at Colorado City treated 92 per cent of all the ore shipped from the Cripple Creek district; the smelters treated 8 per cent. Of the ore treated in the mills, about 60 per cent was treated by cyanidation at the Golden Cycle plant, and 40 per cent by a combined process of chlorination and cyanidation at the Portland, Standard, and Union plants. The Portland Company also was building in 1909 a new mill at the mine, near Victor, which was to use some modification of the cyanide process, and it was reported that this company may change its Colorado City plant so that it will be entirely a cyanide plant. The mills operating in the Cripple Creek district are all cyanide plants, the most important of which is the Stratton's Independence mill. The process used in this mill is said to depend on a most careful concentration to remove as completely as possible the sulphotellurides, followed by cyanidation of the tailings. It was said that a successful method of cyaniding the Gilpin County ores has been discovered.

There has been relatively little prospecting in Colorado in recent years. The leasing system is in vogue in every district in the State. It is estimated that 65 per cent of the precious metal output in 1909 was from the operations of lessees. Unfortunately, in most cases the leasing system results in the abandonment of continued and systematic development work and of the blocking out of ore reserves. In the case of some Cripple Creek mines, however, the leasing system has resulted in maintaining shipments from the upper levels of mines, whose management has been waiting for the completion of the Roosevelt drainage tunnel, rather than operate with the heavy expense of pumping. In some other camps former miners have maintained desultory shipments from mines abandoned by the company. In these cases the miners make little more than wages and continue work mainly because they own homes in the camp.

Cripple Creek district showed a decrease of over a million dollars from the output of the prosperous year of 1908. Several of the large companies of the district curtailed their product and waited for their mines to be unwatered by the drainage tunnel. The smaller local cyanide plants made a reduced yield in 1909. The Roosevelt drainage tunnel was advanced steadily during the year, and by January 1, 1910, was in over 12,000 feet, with 3,500 feet yet to be completed. The contractors expected to complete the work by January, 1911. As yet no heavy flow of water has been encountered, one small water course giving off about 100 gallons a minute. In December, 1909, the United States Reduction and Refining Company reduced charges for freight and treatment on $10 ore to $4 a ton, with the result that more low-grade ore was marketed. "High grading" was less prevalent in 1909 than in former years.

Leadville made an increased production in 1909 in all five metals. There was some mining in what S. F. Emmons has called the Downtown district[a] (which includes Fryer and Carbonate hills), but the bulk of the ore came from the mines on Iron and Breece hills, and was either siliceous ore or mixed sulphide ores. Of the tonnage treated in Leadville 6.7 per cent was true lead oxide ore; 6.6 per cent was siliceous ore; 22 per cent, iron-manganese fluxing ore (carrying a little lead and silver); and 64.7 per cent, mixed sulphide ores. The advance in the price of spelter during the year was sufficient to increase greatly the shipments of zinc ores. The Yak tunnel had passed the Resurrection No. 2 shaft at the close of the year, and was headed for the Diamond property; the length of the main drive was 3.32 miles. At the 3-mile mark a lateral was driven for 1,000 feet to the New Monarch mine.

Ouray County, in which is the Camp Bird mine, made an increased yield in gold and lead, as the result of the operations of that mine, which was sufficient to cover the decrease in those metals in San Juan and San Miguel counties. Silver, copper, and zinc yields from the "San Juan" counties—Dolores, La Plata, Ouray, San Juan, and San Miguel—showed decreases. The "San Juan" district was heavily handicapped by a very severe spring and by washouts on the railroad in the summer and fall. Active shipping from Ouray, and more particularly from Silverton and Telluride, was not possible until after March, and Silverton was cut off from railroad transportation by washouts for forty-six days in July and August and again for nearly forty days in September and October. On September 5 the railroad between Telluride and Placerville was washed out by the bursting of the Trout Lake reservoir, which supplies the Telluride Power Company's electric plant. Several companies suspended operations for a short time because of shortage of coal and supplies. Transportation by railroad to Durango (to which point ore and concentrates are shipped) was resumed on October 25 and to the north on December 7, 1909. La Plata County's output, though small, showed a material increase.

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[a] The Downtown district of Leadville, Colo.; Bull. U. S. Geological Survey No. 320, 1907.

Lower Clear Creek County and Gilpin County showed a decrease for 1909, but upper Clear Creek districts increased their yield. The breast of the Newhouse tunnel (from Idaho Springs, Clear Creek County, toward the Gunnell mines in Central City, Gilpin County) crossed the line of Nevada Gulch, in Gilpin County, at the close of the year, and the tunnel should reach completion before the end of 1910.

The yield from Mineral County (Creede) was slightly increased. In November, 1909, the Humphreys custom mill was started, and additional men were put at work on several properties to maintain a supply of ore to keep the mill running. Several other properties, however, have stopped work on company account and the mines have been left in charge of lessees.

Boulder County mines were somewhat more active than for several years past, and the output showed an increase. Chaffee County increased its yield in copper and zinc, but silver and lead outputs decreased, as did that of gold despite an increase in placer yield. Dolores County production fell off because of lessened operations at Rico. Eagle County mines were active under lease. Park County showed an increased production for all the metals except zinc. The yield from Pitkin County (Aspen) increased slightly. Both dredges and lode mines increased very considerably the yield of Summit County.

DREDGING IN COLORADO.

The dredges near Breckenridge, Summit County, produced roughly 20,000 fine ounces of gold in 1909, an increase of 14,000 fine ounces. There were 4 dredges in operation in 1909: The Colorado Gold Dredging Company had 1 dredge in Blue River and 1 in Swan River; the French Gulch Dredging Company operated in French Gulch on the Mecca placer; and the Reliance Gold Dredging Company also operated in French Gulch.

The following table shows the production of gold, silver, and associated metals in Colorado, by counties:

Mine production of gold, silver, copper, lead, and zinc in 1909 in Colorado, by counties.

County.	Producing mines.	Tonnage of deep mines.	Gold.		Silver.	
			Quantity.	Value.	Quantity.	Value.
		Short tons.	*Fine ounces.*		*Fine ounces.*	
Boulder	56	13,188	7,898.33	$163,273	48,183	$25,055
Chaffee	27	10,214	1,474.71	30,485	35,477	18,448
Clear Creek	150	116,753	25,948.69	536,407	448,535	233,238
Custer	9	5,871	617.94	12,774	14,796	7,694
Dolores	10	4,787	1,077.12	22,266	103,646	53,896
Eagle	16	11,526	2,578.77	53,308	125,214	65,111
Fremont, Grand, Jefferson, and Montezuma	4	6	66.28	1,370	17	9
Gilpin	244	111,118	42,923.67	887,311	172,010	89,445
Gunnison	18	9,071	5,248.35	108,493	37,423	19,460
Hinsdale	10	1,697	367.02	7,587	75,731	39,380
Lake	97	417,297	69,438.97	1,435,431	3,423,642	1,780,294
La Plata	10	4,135	6,149.38	127,119	74,152	38,559
Larimer	1	48	....	....	....	....
Mineral	7	64,941	5,264.41	108,825	891,185	463,416
Ouray	30	103,864	147,293.41	3,044,825	345,815	179,824
Park	16	15,046	26,699.18	551,921	102,375	53,235
Pitkin	12	112,448	36.04	745	700,038	364,020
Routt	5	24	162.59	3,361	3,446	1,792
Saguache	8	192	57.85	1,196	2,260	1,175
San Juan	40	187,041	33,053.04	683,267	793,637	412,691
San Miguel	40	423,609	110,539.34	2,285,051	1,344,152	698,959
Summit	32	31,098	21,902.56	452,766	99,763	51,877
Teller	83	575,670	554,893.81	11,470,673	60,017	31,209
Unapportioned	....	97	42.67	882	1,119	582
Total	925	2,219,741	1,063,734.13	21,989,336	8,902,633	4,629,369

County.	Copper.		Lead.		Zinc.		Total value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
	Pounds.		*Pounds.*		*Pounds.*		
Boulder	16,485	$2,143	425,605	$18,301	....	....	$208,772
Chaffee	568,868	73,953	584,492	25,133	947,741	$51,178	199,197
Clear Creek	299,546	38,941	3,254,675	139,951	758,074	40,936	989,473
Custer	700	91	41,721	1,794	89,593	4,838	27,191
Dolores	43,538	5,660	462,373	19,882	167,574	9,049	110,753
Eagle	286,885	37,295	152,280	6,548	740,408	39,982	202,244
Fremont, Grand, Jefferson, and Montezuma	677	88	....	....	....	....	1,467
Gilpin	499,146	64,889	664,581	28,577	....	....	1,070,222
Gunnison	51,815	6,736	493,070	21,202	212,093	11,453	167,344
Hinsdale	714,569	92,894	106,327	4,572	....	....	144,433
Lake	5,182,608	673,739	21,073,992	906,182	38,637,315	2,086,415	6,882,061
La Plata	484	63	2,980	128	....	....	165,869
Larimer	....	....	....	....	30,722	1,659	1,659
Mineral	17,401	2,262	9,036,816	388,583	1,817,296	98,134	1,061,220
Ouray	984,269	127,955	2,813,932	120,999	19,148	1,034	3,474,637
Park	61,023	7,933	2,237,093	96,195	366,574	19,795	729,079
Pitkin	26,092	3,392	13,143,210	565,158	34,741	1,876	935,191
Routt	....	....	....	....	....	....	5,153
Saguache	3,769	490	83,463	3,589	....	....	6,450
San Juan	1,653,192	214,915	9,085,068	390,658	786,518	42,472	1,744,003
San Miguel	501,285	65,167	4,941,370	212,479	804,296	43,432	3,305,088
Summit	3,839	499	3,559,278	153,049	5,798,167	313,101	971,292
Teller	....	....	....	....	....	....	11,501,882
Unapportioned	5,855	761	5,464	235	....	....	2,460
Total	10,922,046	1,419,866	72,167,790	3,103,215	51,210,260	2,765,354	33,907,140

The total tonnage, by kinds of ore treated or sold in each county in 1909, is shown in the following table:

Subdivision of crude ore sold or treated in Colorado in 1909, by counties, in short tons.

County.	Siliceous or dry ores.	Copper ores.	Lead ores.	Zinc ores.	Copper-lead ores.	Lead-zinc ores.	Total.
Boulder	13,051	92	45				13,188
Chaffee	103	4,626	331		21	5,133	10,214
Clear Creek	88,190	496	2,477			25,590	116.753
Custer	5,618		93	160			5,871
Dolores	2,657	1	270		95	1,764	4,787
Eagle	1,541	4,587	50			5,348	11,526
Fremont, Grand, Jefferson, and Montezuma	1	5					6
Gilpin	107,784	2,257	1,077				111,118
Gunnison	8,380	20	109		74	488	9,071
Hinsdale	206	13			1,478		1,697
Lake	[a] 214,109	47,317	[b] 27,504		[c] 727	127,640	417,297
La Plata	4,117		18				4,135
Larimer				48			48
Mineral	26,468		1,904			36,569	64,941
Ouray	101,282	148	111		2,303	20	103,864
Park	8,760		5	65	26	6,190	15,046
Pitkin	13,254		99,194				112,448
Routt	24						24
Saguache	68		117		7		192
San Juan	145,434	1,015	37,767		2,825		187,041
San Miguel	420,625	19	1,254		1,711		423,609
Summit	11,770		2,137	4,741		12,450	31,098
Teller	575,670						575,670
Unapportioned		77	20				97
Total	1,749,112	60,673	174,483	5,014	9,267	221,192	2,219,741
Average recovered value in gold and silver per ton	$13.41	$16.32	$5.41	$1.07	$27.03	$2.34	$11.78

[a] Siliceous and dry. Iron manganese oxide and iron sulphide.
[b] Lead oxide, only.
[c] Lead and copper sulphides.

The tonnage of ore sold or treated, the number of deep mines producing, and average value per ton of ore reported by deep mines in Colorado in 1908 and 1909, by counties, as shown in the following table:

Tonnage of ore sold or treated, number of deep mines producing, and average value per ton of ores from deep mines in Colorado in 1908 and 1909, by counties.

County.	Total tons of ore sold or treated.		Number of deep mines producing.		Average total value per ton.	
	1909.	Increase (+) or decrease (−).	1908.	1909.	1908.	1909.
	Short tons.	*Short tons.*				
Boulder	13,188	+ 2,892	38	56	$16.17	$15.83
Chaffee	10,214	+ 1,442	13	26	17.68	17.59
Clear Creek	116,753	+ 7,081	95	146	9.87	8.44
Custer	5,871	+ 2,271	7	9	5.20	4.63
Dolores	4,787	− 6,237	5	10	17.53	23.14
Eagle	11,526	+ 8,517	8	14	37.62	17.45
Fremont, Jefferson, Grand, and Montezuma	6	− 42	5	3	26.50	46.50
Gilpin	111,118	− 9,643	110	244	10.61	9.63
Gunnison	9,071	− 5,368	16	18	9.46	18.45
Hinsdale	1,697	+ 717	10	10	55.89	85.11
Lake	417,297	+ 8,586	61	96	12.95	16.49
La Plata	4,135	+ 1,727	9	10	57.80	40.11
Larimer	48	+ 48		1		34.56
Mineral	64,941	+ 3,810	7	7	10.27	16.34
Ouray	103,864	+ 7,371	21	30	25.43	33.45
Park	15,046	+ 3,674	13	14	42.65	46.83
Pitkin	112,448	−20,960	18	12	6,78	8.32
Rio Grande		− 9	1		84.88	
Routt	24	+ 20	1	1	497.24	113.33
Saguache	192	+ 16	5	8	30.12	33.59
San Juan	187,041	−15,602	42	40	10.78	9.32
San Miguel	423,609	− 4,622	25	39	8.08	7.80
Summit	31,098	+16,467	18	27	14.42	18.11
Teller	575,670	−25,503	96	83	20.51	19.83
Unapportioned	97	− 803			5.75	26.36
Total	2,219,741	−24,150	624	904		
Average value per ton			$14.16	$15.07		

The following table shows the number of producing mines in Colorado, classified by chief product, in 1909, by counties:

Number of producing mines in Colorado in 1909, classified by chief product, by counties.

County.	Gold placer mines.				Deep mines.																	Total mines producing.
	Hydraulic.	Surface.	Dredge.	Total placers.	Gold.	Silver.	Copper.	Lead.	Zinc.	Gold-silver.	Gold-silver-copper.	Gold-silver-lead.	Gold-copper.	Gold-lead.	Silver-copper.	Silver-copper-lead.	Silver-lead.	Silver-lead-zinc.	Copper-lead.	Lead-zinc.	Total deep mines.	
Boulder					50	1	1			4											56	56
Chaffee	1			1	5	4	4	5	1	3			1	1			1			1	26	27
Clear Creek		4		4	87	17		5	2	26	1		1	2			2	2		1	146	150
Custer						6		1	1	1											9	9
Dolores						5		3		1									1		10	10
Eagle	1	1		2	6	3			1	1	1				2						14	16
Fremont													1								1	1
Grand	1			1																		1
Gilpin					224	2	4	2		10		1					1				244	244
Gunnison					7	4	3			1							2			1	18	18
Hinsdale					1	2	1			3					2		1				10	10
Jefferson					1																1	1
Lake		1		1	19	27	1	13	4	5	3	2		7	1		9	1		4	96	97
La Plata					6					3							1				10	10
Larimer									1												1	1
Mineral					3			2									2				7	7
Montezuma					1																1	1
Ouray					11	6	4	2		2		1			2		2				30	30
Park	2			2	6	3			1	1					1		1		1		14	16
Pitkin					1	8		2									1				12	12
Routt	4			4						1											1	5
Saguache					4	1		3													8	8
San Juan					16	5	1	8		3		1	1	1	2	1	1				40	40
San Miguel		1		1	19	2		3		6		4		1	1		3				39	40
Summit		1	4	5	5	5		7	3	2				2			2			1	27	32
Teller					83																83	83
Total	9	8	4	21	555	101	19	56	14	73	5	9	4	14	11	1	29	3	2	8	904	925

Tonnage of ore to gold and silver mills and concentrating mills, with quantity of gold and silver contained in bullion produced in Colorado in 1909, by counties.

County.	Ore to gold and silver mills.			Ore to concentrating mills.
	Quantity.	Gold in bullion.	Silver in bullion.	
	Short tons.	*Fine ounces.*	*Fine ounces.*	*Short tons.*
Boulder	4,149	1,212.65	808	5,088
Chaffee				
Clear Creek	52,702	2,745.18	1,160	49,576
Custer	5,595	614.33	7,538	
Dolores	1	52.71	31	3,223
Eagle				5,160
Fremont, Grand, Jefferson, and Montezuma		4.16	8	
Gilpin	79,778	11,827.22	2,382	15,563
Gunnison	8,193	2,925.42	1,851	
Hinsdale		92.25	75	
Lake		2,973.66	842	87,981
La Plata	1,100	45.67	29	
Larimer				
Mineral				38,473
Ouray	100,405	117,095.86	57,321	
Park	735	302.99	82	1,298
Pitkin		36.04	63	65,890
Routt				
Sagauche	21	14.06	2	
San Juan	127,774	12,817.74	4,091	53,167
San Miguel	402,114	80,272.68	189,550	19,024
Summit	7,348	330.00	89	13,215
Teller	530,196	446,519.93	23,860	
Unapportioned				
Total	1,320,111	679,882.55	289,782	357,658

Mine production of gold, silver, and associated metals from Colorado concentrates in 1909, by counties.

County.	Quantity.	Gold.	Silver.	Copper.	Lead.	Zinc.
	Short tons.	*Fine ounces*	*Fine ounces.*	*Pounds.*	*Pounds.*	*Pounds.*
Boulder	518	122.76	12,854	2,193	390,257	....
Chaffee	....	....	....	....	....	....
Clear Creek	11,221	10,835.95	193,422	117,038	2,005,474	677,290
Custer	....	....	....	....	....	....
Dolores	373	267.75	15,390	6,258	150,333	....
Eagle	2,488	146.33	6,344	1,318	82,149	728,498
Fremont, Grand, Jefferson, and Montezuma	....	....	....	....	....	....
Gilpin	13,988	13,191.98	67,770	157,125	253,051	....
Gunnison	1,249	2,170.40	9,593	....	221,074	....
Hinsdale	....	....	....	....	....	....
Lake	38,056	1,112.84	222,419	2,608	3,283,040	19,940,921
La Plata	35	85.13	1,595	228	....	....
Larimer	....	....	....	....	....	....
Mineral	7,751	4,350.32	95,333	6,820	7,185,728	1,759,165
Ouray	10,259	28,315.82	177,548	505,492	2,355,180	....
Park	147	6.35	4,998	....	....	....
Pitkin	12,884	....	128,573	25,720	6,485,955	34,741
Routt	....	....	....	....	....	....
Saguache	....	....	....	....	....	....
San Juan	28,360	18,220.29	357,374	1,346,718	7,149,924	786,518
San Miguel	23,156	27,591.83	1,098,106	357,452	3,928,973	804,296
Summit	3,606	937.89	61,955	408	3,360,628	2,304,644
Teller	....	....	....	....	....	....
Unapportioned	....	....	....	....	....	....
Total	154,091	107,355.64	2,453,274	2,529,378	36,851,766	27,036,073

Mine production of gold, silver, copper, lead, and zinc from Colorado crude ore shipped to smelters in 1909, by counties.

County.	Crude ore.	Gold.	Silver.	Copper.	Lead.	Zinc.
	Short tons.	*Fine ounces.*	*Fine ounces.*	*Pounds.*	*Pounds.*	*Pounds.*
Boulder	3,951	6,562.92	34,521	14,292	35,348	....
Chaffee	10,214	532.36	35,321	568,868	584,492	947,741
Clear Creek	14,475	12,181.51	253,924	182,508	1,249,201	80,784
Custer	276	3.61	7,258	700	41,721	89,593
Dolores	1,563	756.66	88,225	37,280	312,040	167,574
Eagle	6,366	2,378.21	118,866	285,567	70,131	11,910
Fremont, Grand, Jefferson, and Montezuma	6	4.89	....	677	....	....
Gilpin	15,777	17,904.47	101,858	342,021	411,530	....
Gunnison	878	152.53	25,979	51,815	271,996	212,093
Hinsdale	1,697	274.77	75,656	714,569	106,327	....
Lake	329,316	65,338.64	3,200,379	5,180,000	17,790,952	18,696,394
La Plata	3,035	6,018.58	72,528	256	2,980	....
Larimer	48	....	....	....	....	30,722
Mineral	26,468	914.09	795,852	10,581	1,851,088	58,131
Ouray	3,459	1,881.73	110,946	478,777	458,752	19,148
Park	13,013	25,211.52	97,055	61,023	2,237,093	366,574
Pitkin	46,558	....	571,402	372	6,657,255	....
Routt	24	45.62	3,417	....	....	....
Saguache	171	43.79	2,258	3,769	83,463	....
San Juan	6,100	2,015.01	432,172	306,474	1,935,144	....
San Miguel	2,471	2,653.55	56,492	143,833	1,012,397	....
Summit	10,535	1,025.38	32,392	3,431	198,650	3,493,523
Teller	45,474	108,373.88	36,157	....	....	....
Unapportioned	97	42.67	1,119	5,855	5,464	....
Total	541,972	254,316.39	6,153,777	8,392,668	35,316,024	24,174.187

REVIEW BY COUNTIES.

BOULDER COUNTY.

Mine production of gold, silver, and associated metals in Boulder County, Colo., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold....................fine ounces..	7,122.45	$147,234	7,898.33	$163,273	+ 775.88	+$16,039
Silver..............................do....	21,498	11,394	48,183	25,055	+ 26,685	+ 13,661
Copper.......................pounds..	28,955	3,822	16,485	2,143	− 12,470	− 1,679
Lead...............................do....	96,503	4,053	425,605	18,301	+329,102	+ 14,248
Total....................................	....	166,503	....	208,772	....	+ 42,269

The total value of the metallic production from Boulder County in 1909 increased $42,269 over that of 1908. There were increases in gold, silver, and lead, but a decrease in copper.

The number of mines producing was 56, as compared with 38 in 1908. The tonnage reported was 13,188 tons, or 2,892 tons above that of 1908. The average value per ton of ore was $15.83, as compared with $16.17 in 1908, and $22.82 in 1907.

The greater part of the ore in Boulder County was treated in stamp amalgamation and concentration plants, with and without cyanide plants. The average recovery in bullion in 1909 was $6.04 per ton in gold and $0.10 in silver, a total of $6.14. Concentrates produced both at amalgamation mills with concentrators and at mills for concentration only, averaged $4.90 per ton in gold and $12.90 in silver, a total in gold and silver of $17.80; and averaged $32.95 per ton in value of copper and lead combined—a total metal value of $50.75 per ton. The total average recovery per ton in bullion and concentrates showed the average value of all milling ore to be $2.99 in gold, $0.77 in silver, and $1.85 in copper and lead, a total in gold, silver, copper, and lead of $5.61 per ton.

The average value per ton of the smelting ore of Boulder County was $34.34 in gold, $4.54 in silver, and $0.86 in copper and lead combined, a total of $39.74 per ton.

Central district.—This district, near Jamestown, produced gold, silver, and copper in 1909, valued at $19,494, as compared with $30,770 in 1908. All the ore was sent to smelters. Small tonnages were shipped from the Golden Cross, John Jay, Smuggler, and other mines. Lessees on the Wano and Pilot groups shipped several cars of ore during the year.

Gold Hill district.—This district, first in 1908 in point of total value of metallic production, made a decreased yield in 1909, and fell to second place, below Sugar Loaf district. The value of gold was $49,442; the total value of gold, silver, copper, and lead was $56,436, as compared with $69,113 in 1908. The tonnage from 9 mines in 1909 was 1,267 tons, as compared with 5,218 tons from the same number of mines in 1908. The Cash-Birkin mines, the Black Cloud mine, the Ingram mine, and the Slide mine were the most active in the district. Other producers were the Gold Hill, Golden Harp, Lady Franklin, and Seven-Thirty mines.

Grand Island district.—There was a slight increase in output reported from this district, from near Caribou, Cardinal, Nederland, and Rowena. The total value of the yield of gold, silver, and lead from 8 mines was $11,664, as compared with $7,028 from 4 mines in 1908. The Nugget Mining and Leasing Company was the principal producer in this district. The ore was treated in the company's 50-ton amalgamation and concentration mill. Small tonnages were mined from the Bonanza, Prussian, and other mines.

Magnolia district.—The total production of gold and silver from this district was valued at $12,436. Ore from the India mine was treated at the Taylor custom cyanide mill. Lessees on the Poorman mine shipped ore to the Globe smelter. Small tonnages from the Kansas City and the Magnolia mines were sent to smelters.

Sugar Loaf district.—There was a material increase in tonnage mined in this district in 1909; the total value of the output was $66,560, as compared with $26,757 in 1908. This district ranked first in 1909. The Cashier mine supplied a large tonnage to the 75-ton concentration mill, making a high-grade silver-lead concentrate, carrying also some gold. A considerable tonnage was shipped from the Livingston mine. Ore from the Wood Mountain mine was treated in the company's 20-ton amalgamation and concentration mill. Lead ore was shipped from the Yellow Pine, Van Cleuse, Sugar Loaf, and Klondike mines. The product from the Clinton and Logan mines was both in bullion and crude ore shipped. From the Reppy mine were shipped crude ore and concentrates. Among other small producing mines were the Amalgam Thief, the Copper Glance, the Dirigo, the Don D., and the Herald.

Sunshine district.—There was a small output of gold and silver from the Sunshine district. Bullion and crude ore were shipped from the Inter-Ocean mine, and crude ore was shipped from the Richmond mine. There was a small output from the Lottie and other mines.

Ward district.—This district made a production of $27,741 in 1909, as compared with $26,559 in 1908. The Ni Wot and Columbia mines made an increased yield. Ore was shipped from the Celestial Extension, Poorman, Utica, and White Raven mines.

CHAFFEE COUNTY.

Mine production of gold, silver, and associated metals in Chaffee County, Colo., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold....................fine ounces..	2,373.13	$49,057	1,474.71	$30,485	− 898.42	−$18.572
Silver............................do....	35,745	18,945	35,477	18,448	− 268	− 497
Copper.......................pounds..	337,804	44,590	568,868	73,953	+231,064	+ 29,363
Lead..............................do....	1,040,238	43,690	584,492	25,133	−455,746	− 18,557
Zinc...............................do....	703,706	33,074	947,741	51,178	+244,035	+ 18,104
Total................................	....	189,356	....	199,197	....	+ 9,841

The value of the total metallic output of Chaffee County in 1909 shows an increase of $9,841. The tonnage mined in 1909 was all shipped to smelters, and amounted to 10,214 short tons, as compared with 8,772 tons in 1908.

There were 26 productive deep mines and 1 placer. The placer output exceeded that of 1908. The decrease in gold was chiefly in the output from the Chalk Creek district, the decrease in lead in that of the Chalk Creek and Monarch districts. The increase in copper and zinc was caused by heavier shipments from the Monarch (or Garfield) district.

Chalk Creek district.—Ore was shipped in 1909 from the Mary Murphy and two other mines.

Cleora district.—Small lots of ores were shipped from this district in 1909.

Granite district.—Granite district produces all the placer gold in the county. The Cache Creek Leasing Company, working the Twin Lakes placer by hydraulicking, was the only producing placer. Some small shipments of ore were also made.

La Plata district.—A small tonnage was shipped from the Banker group of mines.

Monarch district.—This district showed an increased output in 1909 in all the metals except lead, the total value showing an increase of $46,065.

There were 13 shipping mines in the district. The Monarch-Madonna mine was the chief producer, with an output of twice the tonnage sold in 1908. The Taylor Mountain Mining Company made an increased output. Lead was shipped from the Hawkeye and the Fairview mines. Among other producers were the Giant-Eclipse, Great Monarch, and Silent Friend mines.

Riverside district.—Ore was shipped from the Mount Harvard and the Princeton mines in Riverside district in 1909.

Turret district (including Sedalia).—The Sedalia Copper Company shipped copper ore in 1909. The Golden Wonder mine was a small producer.

CLEAR CREEK COUNTY.

Mine production of gold, silver, and associated metals in Clear Creek County, Colo., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value,
Gold............fine ounces..	31,884.74	$659,116	25,948.69	$536,407	− 5,936.05	−$122,709
Silver..................do....	503,551	266,882	448,535	233,238	− 55,016	− 33,644
Copper..............pounds..	264,994	34,979	299,546	38,941	+ 34,552	+ 3,962
Lead..................do....	2,015,010	84,630	3,254,675	139,951	+1,239,665	+ 55,321
Zinc..................do....	836,411	39,311	758,074	40,936	− 78,337	+ 1,625
Total....................	....	1,084,918	....	989,473	....	− 95,445

The total value of the production of gold, silver, copper, lead, and zinc in Clear Creek County in 1909 was $989,473, a decrease as compared with that of 1908 of $95,445. There were decreases in gold and silver and increases in copper and lead. The quantity of estimated spelter recovered was less, but the value of this metal was greater. The tonnage from the Lower Clear Creek mines showed a material decrease, with decreases in the output of all the metals except lead (with an increase from concentrates), while Upper Clear

Creek mines made a small increase in tonnage, with chief increases in lead and copper.

Ninety-six companies or individuals operated producing deep mines or groups of mines, and there were also shipments of small lots from 50 other mines and prospects—a total of 146 properties from which there was some output in 1909, as compared with 95 producing properties in 1908. There were 4 producing placers in 1909 as compared with 9 in 1908. The tonnage sold or treated in 1909 was 116,753 short tons, as against 109,672 tons in 1908, an increase of 7,081 tons. The average total value per ton was $8.44, as compared with $9.87 in 1908.

The output from placers was $3,846 in gold from small sluicing operations near Idaho Springs.

The average gold and silver value per ton of siliceous ore was $7.25, of which $5.69 was gold; of copper ores, $20.683, of which $12.675 was gold; of lead ores, $21.665, of which $2.251 was gold; and of lead-zinc ores, $2.45, of which $0.71 was gold.

During 1909 there were treated at stamp amalgamation mills in Idaho Springs and Black Hawk 52,702 short tons of ore from Clear Creek County, and the bullion saved on the plates contained 2,745.18 fine ounces of gold, valued at $56,748, an average of $1.076 per ton, and 1,160 fine ounces of silver, valued at $603, an average of $0.011 per ton, a total value of gold and silver of $57,351, and an average total value of $1.09 per ton, as compared with $1.36 in 1908. From this ore and from 49,576 tons sent to mills for concentration only—a total to both classes of mills of 102,278 tons, or 87.6 per cent (as compared with 85.7 per cent in 1908) of all the tonnage produced—there were produced 11,221 tons of concentrates, containing 10,835.95 ounces of gold, valued at $223,999, an average of $19.96 per ton; 193,422 ounces of silver, valued at $100,579, an average of $8.96 per ton; 117,038 pounds of copper, valued at $15,215, an average of $1.36 per ton; 2,005,474 pounds of lead, valued at $86,235, an average of $7.69 per ton; and 677,290 pounds of zinc, valued at $36,574, an average of $3.26 per ton—a total value of $462,602, and a total average value in gold, silver, copper, lead, and zinc of $41.23 per ton.

There were produced from the 102,278 tons of ore to both classes of mills, $280,747 in gold, from both bullion and concentrates, or an average of $2.74 per ton, and $101,182 in silver, or an average of $0.99, or a total average in gold and silver of $3.73 per ton (as compared with $5.26 in 1908) for all milling ore; and $138,024 in copper, lead, and zinc, combined, or an average of $1.35—a total average gross value in all five metals of $5.08 for all milling ore.

Crude ore shipped to smelters amounted to 14,475 tons, which contained 12,181.51 ounces of gold, valued at $251,814, an average value of $17.40 per ton, and 253,924 ounces of silver, valued at $132,041, an average value of $9.12 per ton—a total in gold and silver of $383,855, and an average value of $26.52 per ton, as compared with $27.39 in 1908; and which also contained 182,508 pounds of copper, 1,249,201 pounds of lead, and 80,784 pounds of zinc, of a value of $81,804, or an average of $5.65 per ton—a total average value in all five metals of $32.17 per ton.

Crude ore and concentrates combined shipped to smelters amounted to 25,696 tons, containing $475,813 in gold, an average of $18.52 per ton; 447,346 ounces of silver, valued at $232,620; and in base metals, 299,546 pounds of copper, 3,254,675 pounds of lead, and 758,074 pounds of zinc, the three metals valued at $219,828, or an average of $8.55 per ton—a total average value of $36.12 per ton.

The average value in gold, silver, copper, lead, and zinc of the entire, tonnage mined and treated was $8.44, of which $4.56 was for gold, $2 for silver, $0.33 for copper, $1.20 for lead, and $0.35 for zinc.

Alice (or Yankee) district.—The total value of the production of five deep mines from this district in 1909 was $14,330. The chief mine was the Lombard group, operated through the Seeman tunnel, 2,300 feet in length. On this property is a 15-stamp, 60-ton amalgamation and concentration mill. Mill tests on ore from the Alice mine, prospecting of which is said to have shown the largest body of low-grade ore in Colorado, yielded a small recovery in bullion.

Argentine district.—From five mines in this district there was sold or treated 2,919 short tons with a total value in five metals of $88,224, an increase of $30,887. Lead and silver are the chief metals produced in this district, with an output for the first of 749,675 pounds, valued at $32,236, and for the second of 47,392 fine ounces, valued at $24,644. The value of the gold was $19,538.

Ore from the Morning Star group, carrying low percentages in lead and zinc with silver as the chief metal, produced lead and zinc concentrates. Lead ore and concentrates were shipped from the East Argentine group, worked through the Sydney tunnel, which was 5,900 feet long in 1909. From the Josephine mine was shipped a considerable tonnage carrying a high per cent of lead. All ore from the Santiago mine was shipped crude to lead and zinc smelters. The ore from this mine carries also gold, silver, and copper. The company operated a sampling plant at Georgetown. From the Independence, Wheeling, Commonwealth, Paymaster, Centennial, and Tobin mines were shipped both crude lead ore and lead concentrates. The mines are opened through three adits, aggregating 12,000 feet. The milling plant is a 100-ton wet concentration mill.

Empire (or Upper Union) district.—This district from four mines produced a total output valued at $38,529, as compared with $39,081 in 1908. The producing mines were the Conqueror group, the Gold Dirt group, the Golconda, and the Mint.

Griffith district.—The output of metals by 15 companies operating mines or groups of mines in the Griffith district in 1909 from 45,414 tons of ore sold or treated was $49,857 in gold, 149,662 fine ounces of silver, 15,817 pounds of copper, 1,502,302 pounds of lead, and 690,770 pounds of zinc, with a total value of $231,639. This was a total increase in value of $28,449. The tonnage increased 8,815 tons. There were small decreases in the yield of gold and zinc, but considerable increases in silver, copper, and lead. The district produced 91 per cent of the zinc output of the county.

The Capital-Tunnel group, near Georgetown, with chief output in gold and silver, was the chief producer in the district. The ore is treated in the 100-ton amalgamation and concentration mill of the company, crushing and grinding being done with crushers and two 6-foot Chilian mills. The mines are opened by an adit 9,000 feet long and a vertical shaft 350 feet deep. From the Mendota-Frostburg group, near Silver Plume, a large tonnage carrying a comparatively low per cent in lead and zinc was concentrated at the 60-ton Mendota mill (with a high ratio of ore to concentrates), making two classes of concentrates, one lead and the other zinc. The concentrates carry silver and some gold. The mill contains crusher and rolls. The Linn Consolidated Mining Company has a 50-ton concentration mill near Georgetown. A considerable tonnage was treated by this company from its Mineral Chief and other mines, with an output in lead and zinc concentrates, carrying also silver and some gold. A small tonnage was mined by lessees on the Dives-Pelican and Seven-Thirty mines. The Pelican mill was run for a time on dump ore from the Pelican mine. The raise from the Phillips drift from the Burleigh tunnel was completed in July, draining the Seven-Thirty shaft. Ore from the Smuggler mine was treated also at the Mendota mill, producing lead and zinc concentrates carrying silver and some gold. A considerable tonnage of lead ore was shipped from the Bellevue-Hudson and Anamosa mines. The Two American Sisters group produced an increased tonnage which was treated in the company's 10-ton stamp, 25-ton concentration mill, making a lead-copper concentrate carrying silver and some gold. Lead ore was shipped by lessees on the West Griffith mine. Crude zinc ore and zinc concentrates were shipped by the Joplin Tunnel Company, the concentrates being produced in the Linn Company's mill. Operators also shipped small tonnages from the Doric dump, Dunkirk, Scepter, Wild West group, and other mines.

Idaho district.—In this district are listed the mines about Idaho Springs, including Banner, Coral, Lower Fall River, Payne's Bar, Spanish Bar, and Virginia subdistricts. Jackson district, usually included in Idaho district, has been considered separately for the year 1909.

Not including 1,061 tons from the Jackson district, there were 52,564 tons of ore mined in the Idaho district in 1909, as compared with 66,147 tons in 1908, a decrease of 13,583 tons. The production of metals from deep mines was $375,378 in gold, 182,163 ounces in silver, 176,101 pounds of copper, and 867,597 pounds of lead, with a total value of $530,302, as compared with $707,838 in 1908, a decrease of $177,536.

The Gem Consolidated mines, worked through the Newhouse tunnel, produced a decreased tonnage in 1909. The Specie Payment ore is all treated at the concentrating plant of the Gem Consolidated Mines Company at Idaho Springs. Crude ore from the Little Mattie group was shipped to smelters, but the bulk of the ore was treated in the company's 30-stamp plate-amalgamation and concentration mill. Ore from the Shafter mine was shipped crude and as concentrates, the latter produced at the custom mill of the Hudson Reduction Company. Lessees on the Sun and Moon group shipped crude ore to smelters as well as to custom concentration mills at Idaho Springs. Almost 90 per cent of the tonnage of the Idaho district for 1909 was from the mines named above.

The Big Five Ore Reduction and Tunnel Company operated the Edgar and the Jewell Lode mines. This tunnel, also known as the Central, was 7,200 feet long at the end of the year 1909. The bulk of the ore was shipped direct to smelters, but some was treated at custom concentration mills. A considerable tonnage of ore carrying chiefly gold and silver, with a little lead and copper, was shipped from the Franklin and the Silver Age mines. Milling and smelting ores were taken out of the Champion-Trio, Castleton, Crown Point, Diamond Joe, Eureka, Mona, and Victor mines, all near the head of Virginia Canyon, and from the Treasure Vault, at the mouth of Virginia Canyon. The Almaden mines, on Fall River, about 2 miles above its mouth produced lead-silver ore of shipping grade. The Lucania tunnel, starting near the mouth of Fall River, was 4,209 feet long at the close of the year 1909. Ore was shipped from the Kinda mine, worked through the Lucania tunnel. Among other producers were the Argo tunnel, Blue Bell, Criterion, Josephine, Refugee, Seaton and Seven-Thirty, Stanley, and Whale mines.

Jackson district.—This district, up Chicago Creek from Idaho Springs, on Cascade, Chicago, and Ute creeks, included the following producing mines in 1909: The Consolidated Quito group, the Katie Emmett, the Black Eagle, operated by the Honest John Mining and Tunnel Company (with a tunnel 2,000 feet long), and the Humboldt. The Burns-Moore Mining and Tunnel Company had driven 7,000 feet of its adit into Chicago Mountain by the end of the year 1909.

Montana district.—This district, near the towns of Dumont and Lawson, was more active in 1909 than in many years. A considerable tonnage was treated in the Pioneer mill from the Pioneer group. Considerable ore was also shipped from the Albro mine. Among other producers were the Commodore and Tropic mines.

Trail Creek district.—The total value of the output of this district in 1909 showed a decrease. The chief producer in 1909 was the Lamartine group. Several shipments were made from the Freeland-Extension group, the Freeland group, the New Era, and the Poorman mines during the year. The North American Smelter and Mines Company, operating the Centurion, Donaldson, International, and several other groups, shipped only a few carloads in 1909, but did a large amount of development work in preparation for shipments to its Golden smelter in 1909. Small shipments were made from the Turner and other mines.

CONEJOS AND COSTILLA COUNTIES.

There was no production from these counties in 1909.

CUSTER COUNTY.

The value of the output from Custer County in 1909 showed an increase of $7,949. From nine properties there were produced $12,774 in gold, 14,796 ounces of silver, 700 pounds of copper, 41,721 pounds of lead, and 89,593 pounds of zinc.

There was an increase in gold, silver, and copper output, and a recovery of zinc for the first time, but the lead decrease was considerable.

In 1909 there were 5,618 tons of siliceous ore treated or shipped to smelters, with an average value per ton of $3.04 in gold and silver. Of lead ore, 93 tons, valued at $36.18 per ton in gold and silver, were shipped.

The Gladstone Reduction Company, operating on the dump of the Bassick mine, at Querida, increased the capacity of the cyanide plant at the beginning of 1909 to 60 tons per day, and made an increased yield. Several mines near Silver Cliff were worked and shipments of ore were made. These were the Bismuth, Bull Domingo, Geyser group, and other mines.

The Marion Mines and Mill Company, at Fairview, shipped some zinc ore to smelters.

DOLORES COUNTY.

Dolores County in 1909 produced 4,787 short tons of ore, containing $22,266 in gold, 103,646 ounces of silver, 43,538 pounds of copper, 462,373 pounds of lead, and 167,574 pounds of zinc, with a total value of $110,753, a decrease as compared with that of 1908 of $82,528. There were 10 producing properties. There was a decrease in the production of all the metals except copper, and the increased yield of that metal was small.

There were 3,223 tons of ore treated in concentrating mills, with an average value in gold and silver in the concentrates produced of $36.32, and 1,563 tons of crude ore were shipped to smelter, with an average value in gold and silver of $39.36.

Lone Cone district.—The producers of this district in 1909 were the Emma and the Smuggler mines, the ore from both of which runs fairly high in gold and silver.

Pioneer district (*or Rico*).—Mining operations in this old district were not as active as in 1908. There was a reduced yield of all the metals, except copper. The principal producers were the United Rico mines, from which both crude ore and concentrates were shipped. Among other mines from which ore was shipped were the Lillie D., Newman, Payroll, Sheridan, and W. J. Bryan.

EAGLE COUNTY.

Mine production of gold, silver, and associated metals in Eagle County, Colo., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold .... fine ounces..	2,812.09	$58,131	2,578.77	$53,308	− 233.32	−$4,823
Silver .... do....	86,715	45,959	125,214	65,111	+ 38,499	+19,152
Copper .... pounds..	66,141	8,731	286,885	37,295	+220,744	+28,564
Lead .... do....	11,204	471	152,280	6,548	+141,076	+ 6,077
Zinc .... do....	....	....	740,408	39,982	+740,408	+39,982
Total	....	113,292	....	202,244	....	+88,952

The value of the mineral production of Eagle County in 1909 showed an increase of $88,952, as compared with that of 1908. Despite an increase in placer gold, the quantity of gold recovered from smelting ore and concentrates decreased $4,823 in value. The quantity of silver, copper, lead, and zinc increased materially, the yield of zinc being larger than in 1907. There was no output of zinc in 1908. There were 16 producing mines, 2 of which were placers, in 1909, as compared with 8 deep and 2 placer mines in 1908. The tonnage sold or treated was 11,526 tons, as compared with 3,009 tons in 1908. There was an increased tonnage to smelters, as well as a large tonnage treated in separating mills. The gross assay value per ton of ore was $17.45, of which $4.53 was for gold, $5.65 for silver, and $7.27 for copper, lead, and zinc combined. The ore to smelters averaged $7.72 in gold and $9.71 in silver, a total in gold and silver of $17.43 per ton.

Battle Mountain district.—Ore from the Iron Mask group was treated in the company 60-ton magnetic separation mill, and several shipments to smelters were also made. All five metals were recovered. A large tonnage of copper ore was shipped from the Rocky Point mine. A considerable tonnage of ore, carrying gold and silver, was shipped by lessees on the Ground Hog mine. Among other mines from which ore was shipped were the Ben Butler, Bleak House, Pine Martin, Rocky Point, Wyoming Valley, and the Marvel, Wonder, and Ransom (worked as one property).

Holy Cross district.—The South Homestake Mining Company worked its placer by hydraulicking.

Girard Mountain district.—A small shipment was made from the Bodie and the California mines.

FREMONT COUNTY.

A small shipment of copper ore from the Nest Egg mine at Parkdale was the only output from this county in 1909.

GARFIELD COUNTY.

A new camp in Garfield County, called Goldstone, on East Elk Creek, 9 miles from Newcastle, had its beginning in 1909. A total of 284 feet of tunnel and drifts were driven on the Grey Eagle claim. No ore was shipped in 1909, but development work was done in the winter of 1909 and the spring of 1910, and shipments were made in 1910. There were several other discoveries of some promise.

GILPIN COUNTY.

Mine production of gold, silver, and associated metals in Gilpin County, Colo., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold..............fine ounces..	52,042.21	$1,075,808	42,923.67	$887,311	−9,118.54	−$188,497
Silver..................do....	187,030	99,126	172,010	89,445	− 15,020	− 9,681
Copper...............pounds..	636,371	84,001	499,146	64,889	− 137,225	− 19,112
Lead...................do....	538,143	22,602	664,581	28,577	+ 126,438	+ 5,975
Total....................	....	1,281,537	....	1,070,222	....	− 211,315

In 1909 Gilpin County produced 111,118 short tons of ore, as compared with 120,761 tons in 1908, a decrease of 9,643 tons. The companies or individuals operating mines or groups of mines numbered 118, and there were also 126 small lots from other properties, making a total of 244 mines or groups of mines from which ore was mined. In 1908 there were 110 mines or groups of mines from which ore was mined. There was no placer output in 1908. Individual leasing and prospecting increased as the operations of companies decreased. The production of gold in 1909 was $887,311, a decrease of $188,497.

This decrease was mainly caused by a smaller tonnage of smelting ore mined, but gold production from bullion and concentrates was also less. The production of silver was 172,010 ounces, a decrease of 15,020 ounces. Silver from bullion and concentrates was less than in 1908, but silver in ores to smelter increased, balancing the decrease in silver from other sources. There was more lead in the dry ores marketed, but less copper.

The output of gold from siliceous ore decreased, but the product from copper and lead ores increased. The output of silver from siliceous and copper ores increased, but was less from lead ores.

The siliceous ore mined amounted to 107,784 tons in 1909, a decrease of 9,230 tons. The output of copper ores increased from 1,329 tons to 2,257 tons, and that of lead ores decreased from 2,418 tons to 1,077 tons.

The average value per ton of siliceous ore in gold and silver was $7.77, of which $7.10 was gold.

During 1909 there were treated at the amalgamation mills in Black Hawk and Idaho Springs 79,778 tons of ore from Gilpin County, and the bullion saved on the plates was valued at $244,490 in gold, an average of $3.06 per ton, and $1,239 in silver, an average of $0.02 per ton, a total value in gold and silver of $3.08 per ton. From this ore treated at amalgamation mills and from 15,563 tons of ore sent to mills for concentration only—a total for both classes of mills of 95,341 tons, or 85.80 per cent of all tonnage produced—were produced 13,988 tons of concentrates, valued at $272,702 in gold, an average value of $19.50 per ton, and $35,240 in silver, an average of $2.52 per ton, a total in gold and silver of $307,942, and an average of $22.014 per ton; in addition to gold and silver the concentrates contained 157,125 pounds of copper, valued at $20,426, an average of $1.46 per ton, and 253,051 pounds of lead, valued at $10,881, an average of $0.78 per ton—a total value per ton for concentrates in gold, silver, lead, and copper of $24.25. Those concentrates which contained copper averaged 0.91 per cent in that metal, and those which contained lead averaged 4.4 per cent of lead.

There were recovered from the total milling ore $517,192 in gold from both bullion and concentrates, an average of $5.52 per ton, and $36,479 in silver, an average of $0.39, a total in gold and silver of $553,671, and an average of $5.90 per ton.

Crude ore shipped to smelters amounted to 15,777 tons, valued at $370,119 in gold, averaging $23.46 per ton, and $52,966 in silver, averaging $3.36 per ton, a total in gold and silver of $423,085, an average of $26.82 per ton; crude ore also contained 342,021 pounds of copper, valued at $44,463, an average of $2.82 per ton, and 411,530 pounds of lead, valued at $17,696, an average of $1.12 per ton; a total value for smelting ore in gold, silver, copper, and lead of $30.76 per ton.

The Newhouse tunnel, which in 1907 had attained a distance of 17,000 feet in a northerly direction from the portal of the Great Mammoth mine, was not pushed farther until December, 1908, when driving was again resumed westward for 1,200 feet at an angle of 45 degrees from the previous line. The tunnel was advanced steadily in 1909, turning in a northerly direction again toward the Gunnell group in Nevada district, and at the close of the year had passed under Quartz Hill and Nevada Gulch. The tunnel will drain the

Quartz Hill and Gunnell Hill properties, long idle on account of being filled with water at depths of from 1,500 to 1,700 feet, which in the majority of mines will be from 400 to 700 feet below the depths of their present shafts. The Gunnell group should be reached before the close of 1910.

Gilpin County is divided by somewhat indefinite lines into mining districts having local names, which appear to differ with individuals.

Central district.—This district embraces the vicinity of Central City. The production, though small, showed a slight increase. There was an increased tonnage treated at mills, but a smaller tonnage was shipped to smelters. Among producing mines were the Dean and Casto, Couer de Alene, Huddleston, and Pacific.

Enterprise district.—Small tonnages were mined from the Jennie Blanche and the Bryan Tunnel mines.

Eureka district.—This district, west of Central City, embraces Gunnell Hill and Eureka and Prosser gulches. The output showed an increase in 1909, as it did in 1908. The Eureka mine supplied an increased tonnage to custom mills. Ore from the Concrete mine was sent to the mills and smelters. A considerable tonnage was sent to smelters from the Spur-Daisy mine. Lessees operated the East Whiting and the West Whiting mines.

Gregory district.—This district embraces the town of Black Hawk, and the Gregory, Bobtail, and Bates Hills mines. It is the second district in importance of production, the first being Russell. In 1909 there were 17 mines which produced 36,511 tons of ore, from which was recovered $232,463 in gold, 27,978 ounces of silver, 141,570 pounds of copper, and 35,858 pounds of lead, with a total value of $266,958, as compared with $289,504 in 1908.

Among producing mines in this district were the Alaska, Chicago-Carr dump, German, Fifty Gold Mines group, Nemeha, Next President, O. K., Parole, Senator, Sleepy Hollow, and U. P. R.

The Fifty Gold Mines Corporation, operating the Gregory, Bobtail, Fiske, Cook, Mammoth, and other properties for company account and by lessees made an increased production. This company operates an 80-stamp, 350-ton amalgamation and concentration mill, both on company and custom ore.

The U. P. R. Mining and Milling Company acquired the Gregory Buell 45-stamp custom mill.

A smaller tonnage was mined from the O. K. mine. A considerable tonnage from the Next President mine was milled at the company's amalgamation and concentration mill. The Sleepy Hollow mine was operated during the entire year. The plant of the Clear Creek Mining and Milling Company, below Black Hawk, with 48 canvas tables, 2 Frue vanners, and 2 Wilfley tables, produced concentrates from mill waste.

Illinois Central district.—The Illinois Central district lies about 1 mile south of Central City and embraces Illinois and Leavenworth gulches and the east portion of Quartz Hill. The output was almost doubled in 1909. Among producing mines were the Alps, Baxter, Bezant, East Calhoun, East Missouri, Egyptian, and Great Mammoth. Uranium ores are found in the Kirk and Wood mines.

Lake district.—This district, 1 mile southeast of Central City, and generally known as Lake Gulch, includes the following producing properties: New National Tunnel group, Pittsburg, and Susan Mary.

Nevada district.—This district, embracing the vicinity of Nevadaville, was again the third district in rank of production and showed an increased output for 1909. Among producing mines were the Baker-Missouri, Barnes, Belcher, Bench, California, Columbia, First National-Kansas, Forks, Hawley-Gardner, Hubert, Indiana, Little Pittsburg, Mitchell, Pyrenees, and Rome-Gardner. There were produced 8,620 tons of ore, from which were recovered $79,939 in gold, 14,925 ounces of silver, 55,354 pounds of copper, and 115,514 pounds of lead, with a total value of $99,863, as compared with $70,358 in 1908.

Quartz Valley district.—The center of this district lies 1 mile north of Central City. The total value of the production was $4,072. Among the producers were the Margaret Glennan and Queen of the West mines.

Russell district.—The Russell district lies southwest of Central City, extends to the Clear Creek County line, and is the most important district in Gilpin County. The total production in 1909 was 39,901 tons of ore, from which were produced $350,491 in gold, 102,700 fine ounces of silver, 169,592 pounds of copper, and 370,441 pounds of lead, the total value of the output being $441,871, as compared with $736,045 in 1908.

Among the mines producing precious metals alone in 1909 were the Chase, Pewabic, Two-Forty, War Dance, and West Pewabic. Among mines producing copper in addition to gold and silver were the Argo, Aurora, East Notoway, Federal, Forfar, Gulch, Incidental, Lizzie, Mabel Tunnel, Old Town group, Rockford, and Saratoga group. Among mines producing lead in addition to gold and silver were the Druid and the Topeka, and among mines producing both copper and lead in addition to gold and silver were the Adduddell, Anchor, East Leavenworth, Frontenac, Jefferson, and Kemp-Calhoun and King Bee groups.

Work was started in 1909 on a lateral from the Newhouse Tunnel to the Adduddell and the Druid mines.

Northern districts.—The outlying districts in Gilpin County are Vermilion district, 4 miles northwest of Central City; Pine district, 7 miles northwest of Central City; Independent and Union districts, about 9 miles north of Central City, embracing Perigo and Rollinsville, Lump Gulch, and Moon Gulch sections; and Phoenix district, along the north edge of the county, near the Boulder County line.

Independent and Union districts.—Near Perigo and Rollinsville were the principal mines in the outside districts. The Perigo Mines group were worked by lessees. The Golden Flint mine also was a producer, and there was an increased output from the Smuggler mine. Among smaller producing mines was the Free Gold.

Pine (or Wisconsin) district.—There were three small producing mines in this district near Apex.

Vermilion district.—The Golden Sheaf mine was a small producer in 1909.

GRAND COUNTY.

No ore was shipped from Grand County in 1909. The Gold Curve Placer Company, at Radium, produced considerable gold by hydraulicking.

GUNNISON COUNTY.[a]

Mine production of gold, silver, and associated metals in Gunnison County, Colo., in 1908 and 1909.

Metal.	1908.		1909.		Increase.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold.....fine ounces..	4,839.05	$100,032	5,248.35	$108,493	409.30	$8,461
Silver.....do....	28,664	15,192	37,423	19,460	8,759	4,268
Copper.....pounds..	5,481	724	51,815	6,736	46,334	6,012
Lead.....do....	327,612	13,760	493,070	21,202	165,458	7,442
Zinc.....do....	147,000	6,909	212,093	11,453	65,093	4,544
Total.....	.....	136,617	.....	167,344	.....	30,727

The mineral production of Gunnison County in 1909 showed an increase over that of 1908 in all five metals. The increases were chiefly in Quartz Creek (Pitkin) and Tomichi (Whitepine) districts. There were 9,071 tons of ore sold or treated in the county in 1909.

Box Canyon (*or Bowerman*) *district.*—There were small shipments from two mines in this district.

Cochetopa (*or Sillsville*) *district.*—Lessees on the Maple Leaf mine, at Sillsville, produced an increased amount of bullion and concentrates from the 40-ton amalgamation and concentration mill on the property.

Elk Mountain (*or Crested Butte*) *district.*—There were 2 small producing deep mines in this district in 1909, the Augusta Queen and the Lucky Strike.

Gold brick (*or Ohio*) *district.*—This, near Ohio City, was the leading district in Gunnison County, with Tomichi (or Whitepine) district second. The Gold Links mine produced bullion and concentrates, and gold-silver ore was shipped from the Grand Prize mines. The Raymond 20-stamp mill was run for a short time. The Carter Mining and Milling Company continued development work and prepared to build a 100-ton concentration plant.

Quartz Creek (*or Pitkin*) *district.*—Shipments in 1909 netted about $800.

Rock Creek (*or Crystal*) *district.*—A considerable tonnage of gold-silver ore was shipped from the Black Queen mine.

Tin Cup district.—A small shipment of lead ore was made from the Blistered Horn mine. No production was made by the United Colorado Mines Company, which owns a concentration plant to be operated by electricity from the company's power plant, built in 1909.

Tomichi (*or Whitepine*) *district.*—A little less gold and lead, but more silver, copper, and zinc were produced in this district in 1909, from ore shipped from the Doctor, Morning Star, and Victor mines. This district was second in total value of output.

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[a] For a brief account, see Hill, J. M., Notes on the economic geology of southeastern Gunnison County, Colo., Bull. U. S. Geol. Survey No. 380, 1909, pp. 21-40.

HINSDALE COUNTY.

Mine production of gold, silver, and associated metals in Hinsdale County, Colo., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold.................fine ounces..	118.71	$2,454	367 02	$7,587	+ 248.31	+$5,133
Silver.......................do....	29,498	15,634	75,731	39,380	+ 46,233	+23,746
Copper...................pounds..	188,698	24,908	714,569	92,894	+525,871	+67,986
Lead.........................do....	280,465	11,780	106,327	4,572	−174,138	− 7,208
Total........................	....	54,776	....	144,433	....	+89,657

Hinsdale County, in 1909, produced 1,697 short tons of ore, all shipped to smelters and valued at $144,433, an increase of 717 tons in quantity and of $89,657 in value. There were 10 productive mines in each year. There was an increase in gold, silver, and copper, but a decrease in lead. There was some gold and silver recovered from small lots, the total tonnage of which was less than 1 ton. The average value per ton of crude smelting ore was $83.96, of which $3.35 was for gold, $23.18 for silver, $54.74 for copper, and $2.69 for lead. The average assay of the crude smelting ore was 0.162 ounces gold, 44.58 ounces silver, 21.05 per cent copper, and 3.13 per cent lead.

Galena district.—This is the chief district in Hinsdale County. The yield from 5 mines was by far the bulk of the county production. The foremost producer in 1909, as in 1908, was the Frank Hough mine, whose ore carries gold, silver, and copper. Ore was shipped from the Cleveland, Fanny Fern, and other mines.

The Hanna Mining and Milling Company drove 1,500 feet in development work in 1909, but the 100-ton concentrating plant on this property was not operated. The Hidden Treasure and the Gallic-Vulcan mines were not producers in 1909.

Lake district.—In this district in 1909, there was a metal output valued at $10,818, as compared with $7,530 in 1908. Among producing mines were the Old Sol and the Pelican.

HUERFANO COUNTY.

There was no production from Huerfano County in 1909. The Copper Bull Mining Company, at Malachite, did considerable development work.

JEFFERSON COUNTY.

A small lot of ore, containing a little gold, was shipped from the Bon Ton mine, near Evergreen. There were several copper properties idle in 1909 in this county.[a]

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[a] Bull. U. S. Geological Survey No. 340, 1908, p. 167.

LAKE COUNTY.

Mine production of gold, silver, and associated metals in Lake County, Colo., in 1908 and 1909.

Metal.	1908.		1909.		Increase.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold fine ounces	59,426.22	$1,228,449	69,438.97	$1,435,431	10,012.75	$206,982
Silver do	2,893,496	1,533,553	3,423,642	1,780,294	530,196	246,741
Copper pounds	4,674,502	617,034	5,182,608	673,739	508,106	56,705
Lead do	19,646,007	825,132	21,073,992	906,182	1,427,985	81,050
Zinc do	23,188,080	1,089,840	38,637,315	2,086,415	15,449,235	996,575
Total		5,294,008		6,882,061		1,588,053

A general revival of mining in all sections of the Leadville district resulted in a decided increase in the yield of all five metals. Some important discoveries were made in the "gold belt" district, and the rise in the price of spelter was sufficient to increase greatly the shipments of zinc ore, both from active mines and from old dumps.

The output of zinc from this county in 1909 was 38,637,315 pounds, as compared with 23,188,080 pounds in 1908, and with 37,412,374 pounds in 1907. The A. Y. and Minnie mine dump was shipped to zinc-separating plants and to zinc smelters, as was also the dump of the Colonel Sellers mine. The Iron-Silver Company was a large producer of zinc.

Lake County in 1909, as in 1908, ranked second to Teller County in value of production and third in tonnage, Teller County being first and San Miguel County second. The Lake County tonnage was 18.7 per cent and the value 20.2 per cent of the respective state totals. This county was again first in the production of silver, copper, lead, and zinc, and in the production of gold it followed after Teller, Ouray, and San Miguel counties.

Of the total state output Lake County produced 38.4 per cent of the silver, 29.2 per cent of the lead, 47.4 per cent of the copper, and 75.4 per cent of the zinc.

In 1909, from 96 properties, there was sold or treated 417,297 short tons, as compared with 61 mines and a tonnage of 408,711 tons in 1908. In quantity the increase was 8,586 tons, and the total average value increased from $12.95 per ton in 1908 to $16.49 per ton in 1909.

Classification of Leadville ores.

	Quantity.	Percentage.
Siliceous:	*Short tons.*	
Gold-silver	28,054	6.7
Sulphide:		
Zinc-iron-lead (zinc blende—pyrite with a little galena)	127,640	30.6
Iron (pyrite, with a little copper, gold, silver, and lead)	142,139	34.1
Total sulphide	269,779	64.7
Oxide:		
Lead	27,504	6.6
Iron-manganese (silver)	91,960	22.0
Total oxide	119,464	28.6
Grand total	417,297	100.0

As shown by this table the greatest tonnage from Leadville in 1909 was of sulphide ore. The chief sulphide ore was iron pyrite, carrying a little copper, gold, silver, and some lead. The bulk of this went direct to the smelter. The tonnage of this class was 142,139 short tons, or 34.1 per cent of the total tonnage. There were also 127,640 tons, or 30.6 per cent, of zinc-iron-lead sulphide (zinc blende—pyrite with a little galena). Sulphide ore made 64.7 per cent of the tonnage.

The higher grade of zinc sulphide ore was shipped direct to the zinc smelters without concentration. The bulk of the zinc sulphide, however, including quite a tonnage of dump ore, was separated magnetically or concentrated at Leadville, Canon City, and Denver.

Next to the sulphide ore the second largest tonnage was of iron oxide, carrying about 10 per cent of manganese and a low per cent of lead, which was usually paid for as iron. This tonnage amounted to 91,960 short tons, or 22 per cent of the total tonnage. Lead oxide ores proper amounted to 27,504 tons, or only 6.6 per cent of the total tonnage.

Siliceous ore carrying gold and silver amounted to 28,054 tons, or 6.7 per cent of the total tonnage.

In the subdivision of the ores of the State on a preceding page the siliceous and dry ores of Lake County include the iron-manganese oxide and part of the iron-sulphide ore and aggregate 214,109 tons, or 51 per cent of the county tonnage.

Some ore containing native gold was mined in several of the Breece Hill mines.

Of both classes of sulphide ore, that part which was milled, amounting to 87,981 tons, or 21 per cent of all the tonnage, made 38,056 tons (at a ratio of concentration of 2.31 to 1) of gold-silver, lead, and zinc concentrates, from which were recovered $23,004 in gold, 222,419 fine ounces of silver, 2,608 pounds of copper, 3,283,040 pounds of lead, and 19,940,921 pounds of zinc. These figures show an average recovery per ton for the crude ore of $0.26 in gold, 2.53 fine ounces of silver, a negligible per cent of copper, and 1.87 per cent of lead. Of those concentrates which were smelted for their zinc content, the average recovery of spelter of the original crude ore was 11.95 per cent. The average zinc assay of the crude ore before being treated was 21.87 per cent. Thus, in 1909, the average recovery of spelter from the crude ore by concentration and separation mills, followed by smelting, was 55 per cent.

The average recovery of all the concentrates showed $0.60 in gold and 5.84 ounces of silver per ton, a negligible per cent in copper, and 4.31 per cent of lead. The average recovery of the zinc concentrates was 28.42 per cent (in terms of spelter recovered). The average assay of the zinc concentrates as shipped to smelters was about 35.53 per cent.

The tonnage of ore sent direct to the smelter, the bulk of which was the oxide and siliceous ores, with some lead-zinc ore and some iron-pyrite carrying copper, lead, gold, and silver, was 329,316 tons, 79 per cent of all the tonnage. This tonnage contained $1,350,670 in gold, 3,200,379 fine ounces of silver, 5,180,000 pounds of copper, 17,790,952 pounds of lead, and 18,696,394 pounds of zinc (in terms of spelter recovered). The average theoretical assay of the smelting ore was, therefore, $4.10 in gold and 9.72 ounces of silver. An average theoretical assay of lead, copper, and zinc, based on the total tonnage smelted, has no value, as much ore did not carry lead, a greater part of the ore did not carry copper, and only a small part carried zinc. However, the average assay, in terms of recovered metal of what ore carried copper, was 1.34 per cent, of that which carried lead was 3.21 per cent, and of that which carried zinc was 21.38 per cent. The average assay content of crude ore shipped was 25.63 per cent zinc.

The Iron Silver Mining Company mined an increased tonnage in 1909. The annual published report of the company gives a total tonnage of 74,166 tons, valued at $447,024, an average of $6.02.[a] Ore was shipped from the Moyer mine and dump and from the Tucson mine. Ore from the Ibex Mining Company's Little Johnny mine was shipped to smelters, and concentrates were produced from the Ibex dump at the Leadville District Company's mill. The Yak Mining, Milling and Tunnel Company continued to operate steadily and mined a large tonnage from the various properties held by the company.

The Yak tunnel had passed the Resurrection No. 2 shaft at the close of the year, and was headed for the Diamond property. The length of the main drive was 3.32 miles. At the 3-mile mark a lateral was driven for 1,000 feet to the New Monarch mine.

Most of the ore from the mines of the Western Mining Company was shipped direct to smelters, the 200-ton concentrating plant of this company being closed in April, 1909. An increased tonnage was shipped from the A. Y. and Minnie mine; and the dump of this mine, sold to the U. S. Zinc Company and the Empire Zinc Company, was also shipped to Pueblo and Canon City.

An increased tonnage of gold-silver ore containing appreciable quantities of lead and copper was shipped from the New Monarch and Cleveland mines, and lessees on the Breece mine shipped a large tonnage of oxide iron ore (with a trace of manganese) with values in gold and silver. A large tonnage of zinc ore was also shipped from the Colonel Sellers dump.

The Grand Prize and Curran mines were operated and a considerable tonnage was shipped from the Sunday mine. The Dinero Mining and Tunnel Company, in the Sugar Loaf district, was a regular shipper, and ore was also shipped from the St. Louis Tunnel mines.

Other productive mines of note were: On Breece Hill, the Big Four lease, Big Six lease, Fannie Rawlings, Garbutt, Highland Chief, Humboldt, St. Crispen, and Valley; on Iron Hill, the Adelaide, Forest Queen, Little Nell, Rubie, and Star of the West; on Fryer Hill, the Boreel, Chrysolite, Denver City, Dunkin, Evelyn, Forest City, Matchless, Little Chief, Little Sliver, Result, and Robert Emmett; on Carbonate Hill, the Jolly, Morning Star, and Shamrock; in the Down Town district, the Coon Valley and the Midas (including the Hibschle); and in South Evans gulch, the Silent Friend.

LARIMER COUNTY.

Zinc ore shipped was from Larimer County in 1909, from west of Fort Collins.

LA PLATA COUNTY.

From 4,135 short tons of ore there were produced in 1909 in La Plata County 6,149.38 fine ounces of gold, valued at $127,119; 74,152 fine ounces of silver, valued at $38,559; and nominal quantities of copper and lead, the value of the total yield being $165,869, an increase of $26,681. Production was made by 10 companies as compared with 9 in 1908, the ore from all but one of which was shipped to smelters. The average value of the total tonnage was $30.74 in gold and $9.33 in silver, a total of $40.07 in gold and silver, as compared with $42.07 in gold, and $15.73 in silver, a total of $57.80 per ton in 1908.

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[a] Eng. and Min. Jour., April 30, 1910, p. 912.

The May Day and Valley View group were worked steadily and high-grade gold-silver ore was shipped to smelters. Ore was also sent out from the Lucky Moon, Tomahawk, and other mines. Ore from the Cumberland mine, at the head of the La Plata River, was treated in the 40-ton amalgamation and concentration mill on the property.

MINERAL COUNTY.

Mine production of gold, silver, and associated metals in Mineral County, Colo., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold.....fine ounces..	5,759.67	$119,063	5,264.41	$108,825	− 495.26	−$10,238
Silver.....do....	725,602	384,569	891,185	463,416	+ 165,583	+ 78,847
Copper.....pounds.	.....	.....	17,401	2,262	+ 17,401	+ 2,262
Lead.....do....	1,731,987	72,743	9,036,816	388,583	+7,304,829	+315,840
Zinc.....do....	1,100,107	51,705	1,817,296	98,134	+ 717,189	+ 46,429
Total.....	.....	628,080	.....	1,061,220	.....	+433,140

The value of the metallic production from Mineral County in 1909 showed an increase of $433,140 as compared with that of 1908. There was an increased output in all the metals except gold.

Of the total output of 64,941 tons mined, over one-half was milled, the remainder being sent to smelters as crude ore. The total average value of the ore mined in the county in 1909 is represented by the following theoretical assay, based on the returns: Gold, 0.081 ounce; silver, 13.72 ounces; copper negligible; lead, 6.96 per cent; zinc, 1.40 per cent—an average value for 1909 of $16.34 per ton, as compared with $10.27 in 1908. The assay content of zinc concentrates as shipped was 50 per cent of zinc.

As in 1908, there were 7 productive properties in 1909. The Amethyst mine was the chief producer, the output being in concentrates from the 100-ton concentration plant on the property. Some ore from the Creede United mines was also treated in that company's concentrating mill.

A large tonnage of lead-silver ore was shipped from the Last Chance and the Volunteer mines. Ore carrying chiefly silver and lead was shipped from the Bachelor and the Commodore mines. Among other mines from which ore was shipped were the Corsair, and the Holy Moses.

MONTEZUMA COUNTY.

There was a small amount of gold bullion produced in this county in 1909. The output has been combined with that of Fremont, Grand, and Jefferson counties.

MESA COUNTY.

The slag dump of the old smelter at Grand Junction was reworked and sent to smelters during the year.

OURAY COUNTY.

Mine production of gold, silver, and associated metals in Ouray County, Colo., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold............fine ounces..	98,138.26	$2,028,698	147,293.41	$3,044,825	+49,155.15	+$1,016,127
Silver..................do....	415,070	219,987	345,815	179,824	− 69,255	− 40,163
Copper.............pounds..	1,019,574	134,584	984,269	127,955	− 35,305	− 6,629
Lead..................do....	1,675,411	70,367	2,813,932	120,999	+1,138,521	+ 50,632
Zinc..................do....	....	....	19,148	1,034	+ 19,148	+ 1,034
Total..................	....	2,453,636	....	3,474,637	....	+ 1,021,001

Ouray, one of the "San Juan" counties, was one of four counties in the State making a production valued at over $2,000,000 in 1909, and ranked second in production of gold, and third in total metallic production. The yield of gold alone in Ouray County was $3,044,825, and the total metallic value was $3,474,637, an increase of $1,021,001, compared with the total value of 1908. The increase was chiefly in gold production, with also a considerable increase in the lead yield, and some zinc was recovered in 1909, as compared with none in 1908.

The tonnage of ore sold or treated in 1909 was 103,864 short tons, as compared with 96,493 tons in 1908. There were 30 productive mines in 1909 and 21 in 1908. The average total value per ton in 1909 was $33.45, as compared with $25.43 in 1908 and $30.18 in 1907. The average value per ton in gold was $29.32, as compared with $21.02 in 1908.

The tonnage of siliceous ore increased from 90,741 short tons in 1908 to 101,282 tons in 1909; of copper-lead ores, from 768 tons to 2,303 tons; whereas production of lead ores decreased from 248 tons to 111 tons, and of copper ores from 4,715 tons to 148 tons. There were also 20 tons of lead-zinc ore mined in 1909.

During 1909 there were treated at amalgamation and cyanide mills, 100,405 tons, and the bullion contained $2,420,586 in gold, an average recovery per ton of $24.11, and $29,807 in silver, an average recovery of $0.30 per ton, a total value in gold and silver of $2,450,393, and an average value of $24.41 per ton. From the same ore treated at amalgamation mills were produced also 10,259 tons of concentrates, valued at $585,340 in gold, an average of $57.06 per ton, and $92,325 in silver, an average of $9 per ton, a total in gold and silver of $677,665, and an average of $66.06 per ton. The value of both bullion and concentrates from the milling ore was $3,005,926 in gold, an average of $29.938 per ton, and $122,132 in silver, an average of $1.216 per ton, a total in gold and silver of $3,128,058, and an average of $31.154 per ton of all ore milled.

Crude ore shipped to smelter amounted to 3,459 tons, valued at $38,899 in gold, averaging $11.245 per ton, and $57,692 in silver, averaging $16.679 per ton, a total in gold and silver of $96,591 and an average of $27.924 per ton.

Paquin district.—There were but three small producers in Paquin district in 1909.

Red Mountain district.—The total value of the output from this district was one-half as large as in 1908. From 2,079 tons there were produced $3,675 in gold, 16,952 ounces of silver, 429,631 pounds of copper, and 316,744 pounds of lead, with a total value of $81,962. The San Antonio Mining Company was the principal operator of the district, shipping copper-lead ore. Copper-lead ore was also shipped from the Genessee and the Yankee Girl mines. Among other mines from which ore was shipped were the National Belle and the Oom Paul.

Sneffels district.—This is the chief district of Ouray County. There were produced 99,016 tons, from which were recovered $3,001,108 in gold, 282,829 ounces of silver, 505,492 pounds of copper, and 2,435,583 pounds of lead, with a total value of $3,318,623.

The output from the Camp Bird mine showed a decided increase and was in the form of bullion and concentrates from the amalgamation, concentration, and cyanide mill. Production from the Atlas mine was also from the operation of the company's amalgamation and concentration mill. The Revenue mines also made a decided increase in output in bullion, concentrates, and crude ore. A small shipment was made from the Torpedo-Eclipse mine.

Uncompahgre district.—From 15 mines in this district were produced 2,646 tons of ore, from which were recovered $40,025 in gold, 38,548 ounces of silver, 47,454 pounds of copper, 61,605 pounds of lead, and 19,148 pounds of zinc, with a total value of $69,922. The total value in 1908 was $67,499.

An increased tonnage from the American Nettie mine was treated at the mill, and ore was also shipped to smelters. Other principal producers were the Black Girl, the Bright Diamond, and the Uncle Sam mines. Small shipments to smelters were made from the Bachelor, Bonanza King, Cascade, Jonathan, Khedive, O. and N., Pony Express, and other mines.

PARK COUNTY.

Mine production of gold, silver, and associated metals in Park County, Colo., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold.................fine ounces..	20,840.33	$430,808	26,699.18	$551,921	+ 5,858.85	+$121,113
Silver......................do....	12,047	6,385	102,375	53,235	+ 90,328	+ 46,850
Copper..................pounds..	37,106	4,898	61,023	7,933	+ 23,917	+ 3,035
Lead.........................do....	495,985	20,831	2,237,093	96,195	+ 1,741,108	+ 75,364
Zinc.........................do....	728,000	34,216	366,574	19,795	− 361,426	− 14,421
Total........................	....	497,138	....	729,079	....	+ 231,941

The value of the total metallic output of Park County in 1909 was $729,079, as compared with $497,138 in 1908, an increase for 1909 of $231,941. The tonnage sold or treated, the greater part of which went direct to smelters, was 15,046 tons, an increase of 3,674 tons. There were 14 producing deep mines and 2 placers in 1909, against 13 deep and 7 placer mines in 1908. The placer output was greater than in 1908. The average value per ton of all the ore was $46.83.

Buckskin district.—The output from this district in 1909 was valued at $9,680, as against $34,098 in 1908. There were 5 producing mines in 1909 and 4 in 1908. The principal producer was the Paris mine, the ore of which was treated in a 50-ton amalgamation mill. Small shipments were made from the Nelson and other mines.

Consolidated Montgomery district.—There was a decided increase in output from this district in 1909. Shipments were made from the Ling-Star, Pacific, Russia, and Shelby mines. The Pacific and Shelby with other properties were taken over by the Colorado Gold Mining and Smelting Company, which was building a semipyritic smelter at Alma. The output of this district in 1910 will show a material advance.

Mosquito district.—The output from this district also showed an increase, and in 1909 was three-fourths of the total metallic yield of the county. There were 3 producing deep mines and 2 placers.

The London mine, at the head of Mosquito Creek, on the ridge between Leadville and Alma, and near the county lines of Lake and Park, was again the principal producer. Production was also made from the Butte and the Kennebec mines.

Sacramento district.—A small shipment of lead ore was sent to the smelter from the Champaigne mine.

Tarryall district.—One small shipment was made from the Tarryall district in 1909.

PITKIN COUNTY.

Mine production of gold, silver, and associated metals in Pitkin County, Colo., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold........fine ounces..	26.03	$538	36.04	$745	+ 10.01	+ $207
Silver........do....	1,041,700	552,101	700,038	364,020	− 341,662	− 188,081
Copper........pounds..	....	....	26,092	3,392	+ 26,092	+ 3,392
Lead........do....	7,568,060	317,859	13,143,210	565,158	+ 5,575,150	+ 247,299
Zinc........do....	722,362	33,951	34,741	1,876	− 687,621	− 32,075
Total........	....	904,449	....	935,191	....	+ 30,742

There was a small increase in the total value of the output of Pitkin County mines in 1909, and increases in gold, copper, and lead, but decreases in silver and zinc. The tonnage sold or treated in 1909 was 112,448 short tons, as compared with 133,408 tons in 1908.

Pitkin County fell from third place to fifth in 1909 in the production of silver, following Lake, San Miguel, Mineral, and San Juan counties. In the production of lead Pitkin County was again second, with Leadville first and San Juan third.

The quantity of silver reported from lead ores was 485,987 ounces, and from dry ore, which carried less than 4.5 per cent of lead, it was 214,051 ounces. The average assay in silver and lead of all the ore treated or sold was: Silver, 6.2 ounces, and lead, 5.8 per cent.

Roaring Fork (or Aspen) district.—The entire production of this county was from Aspen, with the exception of a small tonnage from Redstone. The Smuggler mine was the largest producer in the district, and the greater part of its tonnage was treated at the Smuggler mill. Considerable tonnages were shipped from the Aspen, Durant, Spar group, and Millinee group mines. Small tonnages were shipped from the Argentum-Juniata, Aspen Fraction, and Mineral Farm mines. Other mines from which ore was shipped were the Bonnybell and the Little Annie.

Lincoln district.—No production was made from the mines of this district, in the southeast corner of the county.

Columbia (or Ashcroft) district.—The Tam O'Shanter-Montezuma Company developed its mine, making no shipments in 1909.

RIO GRANDE COUNTY.

There was no output from Rio Grande County in 1909.

ROUTT COUNTY.

The output in 1909 from Routt County was valued at $5,153, as compared with $5,865 in 1908. Of the output in 1909, gold was valued at $3,361 and silver at $1,792.

Hahns Peak district.—A small tonnage of high-grade gold-silver ore was shipped from the Royal Flush group of the Hahns Peak Gold Mining and Milling Company.

Placer operations in 1909 were on the Nelson Bar and H. L. placers, in the Four Mile district; on the Housel-Melvin and Jack Rabbit placers, near Lay; and on the Nova Scotia (or Blackburn) placer, near Hahns Peak.

SAGUACHE COUNTY.

There was a small increase in the total output from Saguache County in 1909. The Bonanza district showed an increased tonnage of copper-lead or lead ore, carrying also gold and silver, mined and shipped from the Antoro, Mogul, and St. Joe mines. An increased tonnage was also shipped from the Independence mine at Crestone, in the Baca Grant district. This ore carried chiefly gold, with a small quantity of silver. Small tonnages were shipped from the Empress Josephine mine at Blake and from the Comet mine in the Embargo district.

SAN JUAN COUNTY.

Mine production of gold, silver, and associated metals in San Juan County, Colo., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold........fine ounces..	48,269.74	$997,824	33,053.04	$683,267	− 15,216.70	−$314,557
Silver..............do....	1,004,287	532,272	793,637	412,691	−210,650	− 119,581
Copper.........pounds..	2,282,738	301,321	1,653,192	214,915	−629,546	− 86,406
Lead..............do....	8,402,569	352,908	9,085,068	390,658	+682,499	+ 37,750
Zinc..............do....	10,131	476	786,518	42,472	+776,387	+ 41,996
Total............	....	2,184,801	....	1,744,003	....	− 440,798

The value of the metallic production in San Juan County in 1909 showed a decrease from 1908 of $440,798 and was also below that of 1907. There was a material decrease in the output of gold, silver, and copper, but a considerable increase in the yield of lead and zinc.

San Juan County continued to rank second to Lake County in the production of copper, and ranked third in output of lead.

The siliceous ore amounted to 145,434 short tons, as compared with 180,487 tons in 1908. The copper ores decreased from 2,149 short tons to 1,015 tons, the lead ores increased from 19,513 tons to 37,767 tons, and the copper-lead ores increased from 494 tons to 2,825 tons. The zinc ores were from one mine and are included in the siliceous (or dry) ore.

The average precious-metal value per ton of siliceous ore was $5.19, of which $4.06 was gold; of copper ores, $67.18, of which $3.11 was gold; of lead ores, $4.49, of which $2.011 was gold; and of copper-lead ores, $36.64, of which $4.84 was gold.

During 1909 there were treated at amalgamation plants 127,774 tons, and the bullion amounted to $264,966 in gold, an average of $2.07 per ton, and $2,127 in silver, an average of $0.02 per ton—a total value in gold and silver of $267,093 and an average value of $2.09 per ton. From the ore treated at amalgamation mills and from 53,167 tons sent to mills for concentration only a total of 180,941 tons (96.7 per cent of all the tonnage mined) were produced 28,360 tons of concentrates, valued at $376,647 in gold, an average of $13.28 per ton, and $185,835 in silver, an average of $6.55 per ton—a total in gold and silver of $562,482 and an average value of $19.83 per ton. These concentrates also carried 1,346,718 pounds of copper, or an average of 2.37 per cent per ton and an average value per ton of $6.17; 7,149,924 pounds of lead, or an average of 12.61 per per cent per ton and an average value of $10.84 per ton; and 786,518 pounds of zinc, or an average of 1.39 per cent per ton and an average value of $1.50 per ton—a total average value per ton in all five metals of $38.34.

There were produced from the ore to both classes of mills—180,941 tons—from both bullion and concentrates, $641,613 in gold, an average of $3.545 per ton, and $187,962 in silver, an average of $1.038 per ton, a total in gold and silver of $829,575, and an average value of $4.583 per ton for all ore mined; and copper, lead, and zinc to the value of $524,991, an average of $2.90 per ton—a total average value per ton of $7.48.

Crude ore shipped to smelters amounted to 6,100 tons, containing $41,654 in gold, and averaging $6.83 per ton; $224,729 in silver, averaging $36.84 per ton—a total in gold and silver of $266,383 and an average of $43.67 per ton; and also contained 306,474 pounds of copper and 1,935,144 pounds of lead, the two combined valued at $123,052, or an average of $20.17 per ton—a total average value for the smelting ore of $63.84 per ton.

The average value in 1909 in gold, silver, copper, lead, and zinc of the entire tonnage of 187,041 tons was $9.323, of which $3.653 was for gold, $2.206 for silver, $1.149 for copper, $2.088 for lead, and $0.227 for zinc.

Added to a severe spring, which prevented early work and shipping, Silverton was cut off from railroad transportation by washouts for forty-six days in July and August and for nearly forty days in September and October.

Animas district.—The mines of this district are at or near Silverton. The principal producers being the Hercules and the Iowa and Gold Tiger. Next in point of tonnage were the Silver Lakes mines, whose ore was treated in a 300-ton concentration plant. The Dives and Shenandoah mines and the Highland Mary group produced a considerable tonnage of lead and copper ores carrying gold and silver. Other large tonnages were from the Aspen, North Star group, Old Hundred group, and Silver Queen mines.

The Champion group, Columbus, Esmeralda, Joe and John, Little Maud, Pride of the West, and Trilby group were also producers of importance. Small shipments were made from the Black Prince, Brooklyn, Gold Bug, Little Maud, Queen City, St. Paul group, Silver Star, and other mines.

Eureka district.—There were several producers in this district credited with large tonnages in 1909. These were the Kittimac mines, equipped with a 50-ton concentration mill; the Gold King group, with an 80-stamp, 300-ton amalgamation and concentration mill; the Gold Prince group, with a 100-stamp, 350-ton amalgamation and concentration mill; and the Sunnyside group, with a 40-stamp, 125-ton amalgamation and concentration mill. There was also a small production from the Sound Democrat mine and other mines.

SAN MIGUEL COUNTY.

Mine production of gold, silver, and associated metals in San Miguel County, Colo., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold............fine ounces..	112,116.37	$2,317,651	110,539.34	$2,285,051	− 1,577.03	−$32,600
Silver....................do....	1,543,187	817,889	1,344,152	698,959	− 199,035	−118,930
Copper.... ....pounds .	382,402	50,477	501,285	65,167	+ 118,883	+ 14,690
Lead...... ....do....	5,555,049	233,312	4,941,370	212,479	− 613,679	− 20,833
Zinc......................do....	952,872	44,785	804,296	43,432	− 148,576	− 1,353
Total....................	....	3,464,114	....	3,305,088	....	−159,026

The total value of the metallic production of San Miguel County in 1909 was $3,305,088, a decrease of $159,026. The decreases were in gold, silver, lead, and zinc. The lessened output from the Ophir (or Iron Springs) district and the Mount Wilson district caused the decrease in gold, silver, and lead, the zinc output coming from the Upper San Miguel district alone.

The output from 39 deep mines was 423,609 short tons, as compared with 428,231 tons from 25 mines in 1908. The average value per ton was $7.80, as compared with $8.08 in 1908, with $9.08 in 1907, with $10.31 in 1906, and with $9.58 in 1905. The average value per ton in gold in 1909 was $5.39 and in silver $1.65.

The tonnage of siliceous ore amounted to 420,625 short tons, being 99.29 per cent of the entire tonnage. Practically all the gold and silver produced came from this class of ore. The output of lead ores was 1,254 tons, of copper ores 19 tons, and of copper-lead ores 1,711 tons.

San Miguel County in 1909 ranked second to Teller County in tonnage mined, and third after Ouray and Teller in value of gold produced. In silver yield San Miguel was again second, with Lake County first. In total value of metals produced San Miguel County stood fourth, with Teller first, Lake second, and Ouray third.

During 1909 there were treated at amalgamation and cyanide mills 402,114 short tons, or 94.9 per cent of all the tonnage mined; and the bullion was valued at $1,659,383 in gold, an average of $4.126 per ton, and $98,566 in silver, or an average of $0.245 per ton, a total value in gold and silver of $1,757,949, or an average value of $4.371 per ton, as compared with $4.50 per ton in 1908. Therefore 59 per cent of the gold and silver produced in the county from all sources was recovered as bullion. From the ore treated at amalgamation and cyanide mills, and from 19,024 tons sent to mills for concentration or separation only, a total of 421,138 short tons, or 99.4 per cent of the total tonnage, there were produced 23,156 tons of concentrates, valued at $570,374 in gold, an average of $24.63 per ton, and $571,015 in silver, an average of $24.66 per ton, a total in gold and silver of $1,141,389, and an average of $49.29 per ton, as compared with $24.34 per ton in 1908; there were also recovered from the concentrates 357,452 pounds of copper, valued at $46,469, or an average of 0.77 per cent, and an average value of $2.007 per ton; 3,928,973 pounds of lead, valued at $168,946, or an average of 8.48 per cent, and an average value of $7.30 per ton; and 804,296 pounds of zinc, valued at $43,432, or an average of 1.74 per cent, and an average value of $1.876 per ton; a total average value for the concentrates of $60.47 per ton.

There were produced from all milling ore—421,138 tons—$2,229,757 in gold, from both bullion and concentrates, an average of $5.29 per ton, and $669,581 in silver, or an average of $1.59 per ton, a total in gold and silver of $2,899,338, and an average of $6.88 per ton; and also copper, lead, and zinc, with a combined value of $258,847, or an average of $0.62 per ton; a total average recovered value for all milling ore in gold, silver, copper, lead, and zinc of $7.50 per ton.

Crude ore to smelters amounted to 2,471 tons and contained $54,854 in gold, averaging $22.20 per ton; $29,376 in silver, averaging $11.89 per ton, a total in gold and silver of $84,230, and an average per ton of $34.09; and also contained 143,833 pounds of copper, averaging 2.91 per cent, and 1,012,397 pounds of lead, averaging 20.49 per cent, with a combined value for the two base metals of $62,231, an average value of $25.18 per ton—a total average value for the ore smelted of $59.27 per ton.

Upper San Miguel district.—The output from this district in 1909 was 395,462 tons of ore, and $2,200,883 in gold, 1,298,183 fine ounces of silver, 488,715 pounds of copper, 4,528,950 pounds of lead, and 804,296 pounds of zinc. The total value of the production was $3,177,648, as compared with $3,209,561 in 1908. Three large companies of this district furnished over 90 per cent of the total production, as in 1908 and 1907.

From the Argentine group of the Tom Boy Gold Mines Company (Limited) about the same tonnage was treated as in 1908. Zinc was again produced, the first recovery of this metal by this company being in 1908. The equipment of the 350-ton milling plant consists of 60 stamps with amalgamation plates, Frue vanners, Wilfley tables, and a roasting and magnetic separation plant. The output of the Smuggler-Union mines was somewhat less than in 1908. The equipment includes one 80-stamp mill and one 60-stamp mill, each with bumping tables, vanners and concentrators, and also one cyanide plant and a canvas plant. The Liberty Bell mine produced an increased tonnage in 1909. The equipment includes an 80-stamp 400-ton mill, tube mills for regrinding, settlers, agitators, vacuum filters, and concentrators. From the Alta mines a large tonnage was treated in the 100-ton concentration plant on the property, and concentrates were shipped to the Durango smelter.

The 20-stamp amalgamation and concentration plant of the Black Bear group was operated for a short time. Lessees on the Manuel, Nellie, and Silver Chief mines and the Ella Gold Mining Company produced considerable bullion, and bullion and crude ore were shipped from the Contention group. Ore and concentrates were shipped from the Japan-Flora mine and from the 40-ton concentrating plant on the property. Bullion was produced from ore from the Mammoth mines, and several cars of lead ore were shipped from the Lewis mine.

Iron Springs district.—An increased tonnage but a decreased output of metals was made from this district, near Ames and Ophir, in 1909. From 27,995 tons were produced $81,205 in gold, 43,764 ounces of silver, 10,921 pounds of copper, and 399,605 pounds of lead, with a total value of $122,565, as compared with $227,722 in 1908.

There were 15 producing mines in this district, as against 6 in 1908. The Butterfly-Terrible property produced an increased tonnage in 1909, all of which was treated in the company's amalgamation and concentration mill. Ore from the Caribou mine was treated in the company's 20-stamp 60-ton concentration mill. Lead ore was shipped from the Carbonero group. The Favorite mine produced bullion and concentrates from the 20-stamp 50-ton amalgamation and concentration plant, and crude ore and concentrates were shipped from the New Dominion mines. Lessees on the various mines of the Suffolk Mining and Milling Company also shipped bullion and concentrates. Among other producing mines were the Crown Point and the Waterfall.

Lower San Miguel district.—The total metallic production from this district near Sawpit was valued at $3,769, as compared with $14,161 in 1908, from the Lizzie G. and other mines.

Mount Wilson district.—There were small shipments of ore from the Morning Star and the S. B. Kendrick mines in this district in 1909.

SUMMIT COUNTY.

Mine production of gold, silver, and associated metals in Summit County, Colo., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold ... fine ounces..	9,043.27	$186,941	21,902 56	$452,766	+12,859.29	+$265,825
Silver ... do ...	66,025	34,993	99,763	51,877	+ 33,738	+ 16,884
Copper ... pounds..	28,523	3,765	3,839	499	− 24,684	− 3,266
Lead ... do....	1,719,190	72,206	3.559,278	153,049	+1,840,088	+ 80,843
Zinc ... do....	1,232,149	57,911	5.798,167	313,101	+4,566,018	+ 255,190
Total ...	...	355,816	...	971,292	...	+ 615,476

Summit County is the foremost placer producing area in Colorado, and in 1909, as in 1908, the production of zinc was second only to that of Lake County. There was a large increase in output of zinc for 1909. There were increases also in the yield of all the other metals except copper, the output of which was small.

There were 27 producing deep mines in 1909, as compared with 18 in 1908, and the tonnage sold or treated was 31,098 tons, as compared with 14,631 tons in 1908 and with 25,127 in 1907. There were 5 placer mines, 1 operated by sluicing and drifting, and 4 dredges.

There was an increase in output of gold from both deep and placer mines. The increase in gold from deep mines was only $5,835, but that from placer mines was $259,990, the placer output being almost three times as great as in 1908. The increase in silver from deep mines was 30,049 ounces and from placers 3,689 ounces. The silver from deep mines was chiefly from lead-zinc, zinc, and lead ores, there being a decrease in silver from the dry ores of the county.

Breckenridge district.—Breckenridge district includes Bevan, Minnesota, and Union districts.

In the Bevan district the value of the metallic production in gold, silver, copper, lead, and zinc, from deep and placer mines was $793,291, as compared with $114,539 in 1908. A considerable tonnage of zinc ore (carrying a high per cent of zinc) was shipped from the Country Boy mine direct to the smelters. The Wellington mines were the chief producing deep mines, with a large increase in tonnage in 1909, most of which was treated at the company's 75-ton concentrating mill. The equipment of this mill consists of crusher, rolls, jigs, and concentrating tables. Zinc ore was shipped from the Sallie Barber mine and lead ore from the Dunkin mine. Among other producing deep mines in this district were the Old Union and the Standard.

In this district also are the placer properties of the Reliance Gold Dredging Company and of the French Gulch Dredging Company, both of whose dredges were operated, with notable increases in output. The Reliance dredge is of the double lift, open-connected type, with buckets of 9 cubic feet capacity. The Colorado Gold Dredging Company operated 2 dredges, 1 in Blue River and 1 in Swan River, in the Union district. These dredges are of the Bucyrus, open-connected type, with buckets of 9½ cubic feet capacity. All the dredges are run by electricity.

In the Minnesota district there were 7 producing deep mines, the principal ones being the Blue Flag and the Hamilton. Among other producing mines were the Carbonate, Gold-Dust-Puzzle, Silver King, and Washington.

Consolidated Ten Mile district.—This district includes Frisco, Kokomo, and Robinson. The total production in gold, silver, copper, and lead was $21,028, as compared with $79,020 in 1908. The only mines from which considerable tonnages were shipped were the Michigan and the Pearl. Among other producing properties were the Roswell, Sprague, the Mayflower, and the Queen of the West mines.

The International Mining Company, at Robinson, did not produce in 1909, confining its operations to development and the building of a concentration mill.

Snake River (Argentine, Montezuma, and Peru) district.—The Silver King, Silver Wave, and Silver Wing mines produced ore that was treated in the 50-ton concentration plant of the company. Some crude ore was shipped from the Pennsylvania mine near Argentine. There is a 200-ton concentration plant on this property.

There was a material placer output from the Snyder placer, in the Peru district.

TELLER COUNTY.

Mine production of gold and silver in Teller County, Colo., in 1908 and 1909.

Metal.	1908		1909.		Decrease	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold..............fine ounces..	616,311.38	$12,740,287	554,893.81	$11,470,673	61,417.57	$1,269,614
Silver..................do....	60,736	32,190	60,017	31,209	719	981
Total....................	....	12,772,477	....	11,501,882	....	1,270,595

From Teller County (Cripple Creek mining district) in 1909 there was recovered by mills and smelters, from crude ore and dump ore, from the treatment of tailings of previous years, and of tailings from operations in 1909, gold valued at $11,470,673, a decrease, as against the output of 1908, of $1,269,614. From 83 properties, from ore and old dumps, 575,670 short tons of material were sold or treated, not including old tailings re-treated, with an average recovery in gold of $19.83 per ton, as compared with 96 mines and 601,173 tons, averaging $20.51 per ton in 1908.

With the exception of 6 or 8 of the large mines, the output from Cripple Creek was produced by lessees, both as large leasing companies and as individuals. Several of the large companies in the district curtailed their output, working the upper levels only, and waited for their mines to be unwatered by the drainage tunnel. The smaller local cyanide plants made a reduced yield during the year. The Stratton's Independence mill started up in April, 1909, with a capacity of 4,500 tons per month, and was enlarged to treat 7,000 tons in December of that year. The process used depends on a wet concentration to remove as completely as possible the sulpho-tellurides, followed by cyanidation of the tailings and without roasting. In December the United States Reduction and Refining Company reduced charges on freight and treatment on $10 ore to $4 a ton, with a result that more low-grade ore was treated than before at the valley mills.

The Roosevelt deep drainage tunnel was advanced steadily during the year, and by January 1, 1910, was in over 12,000 feet, with 3,500 feet more to be driven. The contractors expect to finish the work by January 1, 1911. As yet no heavy flow of water has been encountered, one small watercourse giving off about 100 gallons per minute.

MILLS AT COLORADO CITY.

In the metallurgical processes used in the mills at Colorado City, the chlorination process began in 1909 to give way to the cyanide process. The large mills at Colorado City and local mills in Cripple Creek district treated 92 per cent of all the ore from the Cripple Creek district (not including tailings from previous years); the smelters treated 8 per cent. Of the ore treated in the mills, about 60 per cent was treated by cyanidation at the Golden Cycle plant, and 40 per cent by a combined process of chlorination and cyanidation at the Portland, Standard, and Union plants. The Portland Company also was building in 1909 a new mill at the mine, near Victor, which is to use a modification of the cyanide process, and it is reported that this company may change its Colorado City plant so that it will be entirely a cyanide plant.

MILLS IN THE CRIPPLE CREEK DISTRICT.

With the exception of the mill on the Isabella property, the small cyanide plants of the Cripple Creek district remained closed during the greater part of the year. Some of the other Cripple Creek mills were the Anaconda, Blue Flag, Trilby, Gaylord, Wild Horse, Ironclad, and W. P. H.

MINES REVIEW.

The production of the Portland Gold Mining Company, as shown by the annual report for its fiscal year, was 83,908 tons, having a gross value of $1,438,650, at an average value of $17.14 per ton, as compared with 94,311 tons, having a gross value of $1,834,081, and an average per ton of $19.45, in 1908. On July 1, 1909, this company ceased pumping, thinking it good business to cut off this expense in view of the rapid progress being made by the new drainage tunnel. On August 1 the mine was put on a working basis of one shift per day, instead of two shifts as heretofore, and produced about 200 tons per day throughout the rest of the year. Although this company could have produced an additional tonnage of ore which would have maintained the running of its mill at full capacity, the ore would have been of such a low grade that it was decided that it would be better to defer the mining of this low-grade ore until it could be treated in the new mill at a far greater profit. The mining operations on the ore bodies above the water level have not only resulted in opening up a certain amount of high-grade ore, but have also developed considerable low-grade ore, which will be needed for the new mill now about completed on the company's property. This will be a 300-ton mill designed to treat low-grade ores and the "Portland method," a modification of the cyanide process, will be used. Grinding will be done by Chilean mills and concentration tables will be used.

Many of the other companies, including the Strong Company, also ceased pumping in July.

The Golden Cycle mines made a reduced yield in 1909. A plant was erected at the mine for crushing and screening low-grade ores.

The Elkton mine made a smaller output in 1909 than in 1908. The shaft on this mine is down 920 feet. The drainage tunnel will drain the mine to a depth of 1,650 feet.

The annual report of the Findley Consolidated Mining Company shows a production for 1909 of 6,819 tons, with a gross bullion value of $155,664. The work done on the sixteenth level, the bottom level of the main shaft, did not show as good values as on the upper levels, but on the same vein at corresponding depth in the Hull City and Vindicator, adjoining the Findley estate, the ore bodies were also smaller and less valuable. In the Vindicator, at 100 feet and 200 feet deeper, the ore bodies have been found much larger. A winze has been sunk 30 feet on the vein below the sixteenth level on the Findley, and it is proposed to sink it 100 feet, in view of the development shown in the Vindicator.

The public annual report of the Granite Gold Mining Company states that during the fiscal year lessees shipped 19,191 dry tons, averaging $22.15 a ton.

The Old Gold Mines Company, in its public report shows that receipts for 1909 from ore sales made by lessees on the Old Gold mine on Beacon Hill were $12,769.

The annual report of the Vindicator Consolidated Gold Mining Company shows a production of 31,664 tons, valued at $895,848, with a gross profit of $132,054. The superintendent reports that 8,000 feet of development was executed from the No. 1 shaft, resulting in the opening of ore bodies of a total length of 1,954 feet on the various levels, as follows: 500-foot level, 199 feet; 700-foot level, 77 feet; 1,100-foot level, 105 feet; 1,200-foot level, 194 feet; 1,300-foot level, 723 feet; and 1,400-foot level, the deepest in the mine, 665 feet. The significant feature of the report is the work performed and the results obtaining in the deepest levels.

The Lexington Gold Mining Company's annual public report shows a production of 789 tons, valued at $13,319.

The El Paso mine made a reduced yield in 1909. This mine was worked on four levels to a depth of 600 feet. The shaft has been sunk to a depth of 1,000 feet, but all the levels below the fourth were under water. This mine will be the first to be drained by the Roosevelt tunnel.

The Granite group was operated wholly under the leasing system, which will continue until the completion of the drainage tunnel enables the management to sink further without the expense of pumping.

The Acacia shaft was 1,100 feet in depth at the close of the year; the mine was worked by lessees. The Ajax shaft was 1,230 feet in depth. The Anchoria-Leland mine produced less than in 1908. There was a small output from the Black Belle mine. The Blue Bird mine was actively operated by lessees. The shaft on this mine has reached 1,350 feet. Ore from the Blue Flag mine was treated at the company's 50-ton cyanide mill, which was operated only a part of the year. A considerable tonnage was shipped from the Christmas mine. An increased tonnage was mined by lessees on the Cameron School Section, on which property there is a shaft 860 feet deep. The Cresson mine was an important producer in 1909, with a largely increased yield; the shaft on this mine is down 1,000 feet. Lessees' operations on the Dante mine yielded a smaller tonnage than in 1908. The Doctor-Jack Pot mine was also operated by lessees. The output of the Findley mine showed a decrease, but a material increase was shown by the Free Coinage mine, and the Gold Dollar mine also made a decided increase. The Gold King mine was operated by lessees. From the Isabella mine ore was supplied to its 300-ton cyanide mill and was also shipped to the valley mills and smelters. The Jerry Johnson mine was operated by lessees, who treated part of the tonnage on the ground in a cyanide plant and shipped the rest to the custom mills. The Mary McKinney mine made an increased output. The Dead Pine and Carbonate Queen mines were operated by lessees. The lessees' output from Stratton's

Independence mine showed a material increase. The Stratton-Cripple Creek mines at Cripple Creek and Altman were important producers. Operations on the Strong mine were materially curtailed. The Trilby Mines Co. completed and operated a cyanide mill during the year. The United Gold mines, operating under the leasing system, made a large output. The Wild Horse and W. P. H. mills of this company were also leased.

Among other important producing mines were the Black Diamond, Chicken Hawk (Katinka Gold Mining Co.), Creede and Cripple Creek, Ethel Louise, Enterprise, Forest Queen, Gold Bond, Gold Issue, Gold Hill Bonanza, Gold Sovereign, Golden Geyser, Happy Year, Homestake, Henry Adney, Hiawatha, Index, Jennie Sample, Keystone, Lady Campbell, Last Dollar, Lexington and Nellie, Mary Cashen, Mary Jane and Mattie L, Midget, Monte Christo, Modoc, Mohican, Moon Anchor, Mountain Beauty, Old Gold, Ophir, Pharmacist, Pilgrim, Pinnacle, Pride of Cripple Creek, Prince Albert, Ramona, Requa-Savage, Rigi, Rittenhouse, Rose Nicol, Ruby, Sheriff, Tornado, Uintah-Ajax, Victor, and Work group.

IDAHO.

By C. N. Gerry.

PRODUCTION.

Returns from 324 producing mining properties in 1909 gave Idaho an output of gold, silver, copper, lead, and zinc valued at $15,660,849. There was a decrease in the number of operators producing, but those reporting were of sufficient consequence to increase the value of the output by $244,250. Gold production increased from 69,827.33 fine ounces, valued at $1,443,459 in 1908, to 70,328.64 fine ounces, valued at $1,453,822 in 1909; but the silver output decreased from 7,469,981 ounces valued at $3,959,090, to 7,041,633 ounces, valued at $3,661,649, a decrease of 428,348 ounces in quantity and of $297,441 in value. The copper production was 9,115,489 pounds, valued at $1,185,014, a decrease of 926,361 pounds in quantity and of $140,510 in value. Large increases were recorded in both lead and zinc.

The quantity of ore mined and shipped or treated was 1,772,383 tons, an increase of 83,152 tons, or nearly 5 per cent. The total value per ton, however, decreased from $8.96 to $8.68, and the value per ton in gold and silver from $3.03 to $2.73. The total tonnage was divided as follows: Ore to gold and silver mills, 171,598 tons, valued at $5.90 per ton in gold and silver; ore concentrated, 1,418,700 tons; crude ore shipped direct, 140,385 tons; and 41,700 tons of old tailings, of which 11,687 tons were treated by amalgamation or cyanidation, while the remainder went to lead concentrators. The latter, with the ore concentrated, resulted in 188,754 tons of concentrates, valued at $10,632,822, or $56.33 per ton. The crude shipping ore was valued at $3,732,480, or $26.59 per ton. The tonnage is also classified according to the kinds of ore into 185,734 tons of siliceous ore, valued at $7.86 per ton in gold and silver, 97,803 tons of copper ore, 1,466,592 tons of lead ore, and some zinc and lead-zinc ore. Lead ore represented nearly 83 per cent of the total, siliceous ore 10.47 per cent, copper ore 5.52 per cent, and zinc ore less than

1 per cent. In 1909 there were 61 mills (including 40 amalgamating or cyaniding mills and 21 concentrating plants) in operation, but some of these were idle a large part of the year. These gold and silver mills, in addition to producing bullion, made 2,110 tons of concentrates containing 9,554.17 ounces of gold, 382,088 ounces of silver, 13,661 pounds of copper, and 16,295 pounds of lead.

Mine production of gold, silver, and associated metals in Idaho in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold.......fine ounces..	69,827.33	$1,443,459	70,328.64	$1,453,822	+ 501.31	+$10,363
Silver..............do....	7,469,981	3,959,090	7,041,633	3,661,649	− 428,348	−297,441
Copper.........pounds..	10,041,850	1,325,524	9,115,489	1,185,014	− 926,361	−140,510
Lead..............do....	206,827,816	8,686,768	215,986,285	9,287,410	+9,158,469	+600,642
Zinc...............do....	37,410	1,758	1,351,010	72,954	+1,313,600	+ 71,196
Total............	....	15,416,599	....	15,660,849	....	+244,250

The production for Idaho for the last six years, as given in the table below, shows an increase in production of ore, metals, and values in 1904, 1905, and 1906, a decline in 1907 and 1908, and a slight increase in 1909.

Total tons of ore sold or treated in Idaho in 1904–1909, and total content of gold, silver, and associated metals.

Year.	Tonnage.	Gold.	Silver.	Copper.	Lead.	Zinc.	Total value.
	Short tons.	*Fine ozs.*	*Fine ozs.*	*Pounds.*	*Pounds.*	*Pounds.*	
1904............	1,668,327	82,739.00	7,666,382	5,087,518	233,096,375	2,600	$16,933,405
1905............	1,669,038	52,033.00	8,679,093	7,321,585	259,812,428	1,228,449	19,743,620
1906............	1,787,673	55,587.73	9,018,815	9,558,913	255,014,446	2,065,597	23,698,400
1907............	1,690,860	60,754.70	8,415,431	10,890,731	233,823,854	6,985,732	21,793,064
1908............	1,689,231	69,827.33	7,469,981	10,041,850	206,827,816	37,410	15,416,599
1909............	1,772,383	70,328.64	7,041,633	9,115,489	215,986,285	1,351,010	15,660,849

GOLD.

The gold output of the State increased only slightly, from 69,827.33 ounces in 1908 to 70,328.64 ounces in 1909. It was a good year in both placer and quartz operations, although gold production from placers decreased slightly. There were considerable increases in Lemhi, Elmore, Blaine, Owyhee, Boise, and Shoshone counties, but a decrease of $190,678 in Custer County alone nearly offset the combined increases. This is accounted for by the unproductiveness of the Lost Packer mine and the reduced output of the Golden Sunbeam mine. Gold production from placers amounted to $281,727, or 19.38 per cent of the total output; and gold from siliceous ore increased to $1,088,052, or 74.84 per cent. The idleness of the Lost Packer smelter was also the reason for the gold production from copper ore decreasing to $24,398, or less than 2 per cent of the total. Lead ore furnished over 4 per cent, or $59,201. Next to the Silver City region, in Owyhee County, which produced nearly 30 per cent of the gold, Boise, Idaho, Elmore, Lemhi, Custer, and Shoshone counties came in order of importance. There were 189 placer properties producing, of which 178 were worked by the hydraulic or the sluicing method, producing $177,164; three by drift mining, producing $2,859; and eight by dredges, producing $101,704. Dredging produced a considerable increase in 1909. Snake River, from nine counties through which it flows, yielded $8,690 in gold and 32 ounces of silver. Crude ore shipped supplied $50,404 of gold, or 35 cents per ton, and concentrates, $267,202, or $1.41 per ton. This amount is divided into $197,502 from concentrates from gold and silver mills and $69,700 from lead concentrates. The former averaged $93.64 per ton and the latter 37 cents per ton.

Source of gold production in Idaho, by kinds of ore, in 1909, by counties, in fine ounces.

County.	Placers.	Siliceous ore.	Copper ore.	Lead ore.	Zinc ore.	Lead-zinc ore.	Total.
Ada	121.95	45.04					166.99
Bannock							
Bingham	151.66	20.51					172.17
Blaine	5.71	1,564.10		363.19		21.45	1,954.45
Boise	6,941.43	3,509.07					10,450.50
Bonner		24.67					24.67
Canyon	15.29						15.29
Cassia	26.75						26.75
Custer	320.34	4,091.44	29.32	1.85			4,442.95
Elmore	160.60	9,186.28					9,346.88
Fremont	6.58			.48			7.06
Idaho	1,380.62	8,546.51					9,927.13
Kootenai and Latah	139.46						139.46
Lemhi	1,164.29	5,096.04	15.10	4.03			6,279.46
Lincoln	43.01						43.01
Nez Perce	2,182.92	19.25					2,202.17
Oneida	88.82						88.82
Owyhee	81.89	20,492.24					20,574.13
Shoshone	666.95	39.38	1,124.96	2,494.31			4,325.60
Twin Falls	130.27						130.27
Washington			10.88				10.88
Total	13,628.54	52,634.53	1,180.26	2,863.86		21.45	70,328.64

SILVER.

The production of silver amounted to 7,041,633 ounces, valued at $3,661,649, a decrease of 428,348 in quantity and of $297,441 in value. The decrease in 1908 was more than double this amount. Shoshone, Owyhee, and Blaine counties led in silver production, Shoshone County, or the Cœur d'Alene region, alone being credited with 88 per cent of the total. Copper ore supplied 599,331 ounces, or 8.51 per cent; siliceous ore, 715,858 ounces, or 10.17 per cent; and lead ore, 5,692,906 ounces, or 80.84 per cent. The remainder, less than 1 per cent, was contributed by placers, zinc ore, and lead-zinc ore. Silver production decreased from all sources, but particularly from siliceous ore and lead ore. Gold and silver bullion contained 303,526 ounces of silver, or less than 2 ounces per ton. Nearly 67 per cent of the silver was derived from concentrates, which averaged 24.84 ounces per ton. From gold and silver mills 2,110 tons of concentrates produced 382,088 ounces of silver, or 181 ounces per ton; and from 186,644 tons of lead concentrates 4,305,736 ounces of silver were derived, or an average per ton of 23.07 ounces. There were 68 deep mines which produced gold and silver.

Source of silver production in Idaho, by kinds of ore, in 1909, by counties, in fine ounces.

County	Placers.	Siliceous ore.	Copper ore.	Lead ore.	Zinc ore.	Lead-zinc ore.	Total.
Ada	32	65					97
Bannock			14				14
Bingham	7	8					15
Blaine	2	6,980		81,411		26,910	115,303
Boise	1,565	6,919					8,484
Bonner		26,142					26,142
Canyon	4						4
Cassia	5						5
Custer	158	4,805	2,242	4,259			11,464
Elmore	34	15,743					15,777
Fremont				1,562			1,562
Idaho	266	7,155					7,421
Kootenai and Latah	14						14
Lemhi	111	607	1,678	3,279			5,675
Lincoln	2						2
Nez Perce	504	12					516
Oneida	5						5
Owyhee	51	647,346					647,397
Shoshone	112	76	594,824	5,602,395	3,750		6,201,157
Twin Falls	6						6
Washington			573				573
Total	2,878	715,858	599,331	5,692,906	3,750	26,910	7,041,633

COPPER.

The production of copper, largely from Shoshone County, was 9,115,489 pounds, valued at $1,185,014, a decrease of 926,361 pounds in quantity and of $140,510 in value. In 1908 a decrease in output resulted from the inactivity of the smelter at Mackay, but, as both this plant and that at the Lost Packer mine were idle in 1909, there was a decrease of 724,921 pounds of copper in Custer County alone. Shoshone County supplied 97.71 per cent of the output, largely from the Snow Storm mine, but partly from silver-lead ores. Some of the ores at Wardner, particularly the Caledonia, have appreciable amounts of copper.

LEAD.

The production of lead in 1909 was 215,986,285 pounds, valued at $9,287,410, against 206,827,816 pounds, valued at $8,686,768 in 1908, an increase of 9,158,469 pounds in quantity and of $600,642 in value. Shoshone County supplied 98.88 per cent of the total, and Blaine County, the next largest producer, supplied less than 1 per cent. Lemhi County will soon take second place, when the Gilmore and Pittsburg Railroad gives the Gilmore mines transportation. The total production will again improve in 1910, but it is not considered probable that the output of the Cœur d'Alene region will ever reach that of 1905, when it was nearly 254,000,000 pounds.

ZINC.

The production of zinc in 1909 was 1,351,010 pounds, valued at $72,954. There was only a slight production during 1908. The zinc industry in Idaho, like that of copper, rests principally with one producer. The Success mine, north of Wallace, was the important shipper, but was idle the greater part of the year, and will be a much heavier shipper during 1910. There are properties at Wardner, Burke, and Murray containing zinc ore associated with galena, but no commercial product has been made. Blaine County was the only other zinc producer.

MINING INDUSTRY IN IDAHO IN 1909.

Idaho production in 1909, in adjusting itself after the panic of 1907, was gradually approaching a normal output, particularly in respect to the production of lead ore. Almost all the ore was, as previously, smelted outside the State. The only smelting operations within the borders were carried on at Hahn, in Lemhi County, and at Ponderay, in Bonner County. At the former place a small lead plant had nothing more than an initial run. The Idaho Smelting and Refining Company treated lead ores the first three months of the year, but the plant was subsequently closed, and material on hand was shipped to another plant. The copper plants of the Empire Copper Company, at Mackay, and the Lost Packer, at Ivers, were inactive. The latter plant added much copper and gold to Custer County production in 1908. Railroad building affecting the mining industry was continued in Shoshone and Lemhi counties. The Chicago, Milwaukee, and Puget Sound Railroad was completed during the year, though the road was not opened for traffic until later. The district affected is that lying along the St. Joe River in southern Shoshone County. The Idaho Northern Railroad, which was completed from Enaville to Murray in January, was continued later in the year to the mines 6 miles east of Murray. This improvement gives a different aspect to lead mining on the North Side, and a foundation for increased shipments as well as further development. The Gilmore and Pittsburg Railroad did construction work to a point near Junction by December, 1909. The road will reach Salmon and be in operation in 1910. A large tonnage at Gilmore was awaiting transportation. There were 9 important mills added to the many reduction plants of the State. Gold and silver mills were erected at the Ironsides mine, in Ada County; the Cannon Ball, in Blaine County; the Golden Age and the Last Chance, in Boise County; the Franklin, in Elmore County; and the Cracker Jack, in Idaho County. Concentration plants were erected at the Alice mine, east of Wallace, and at the Bunker Hill mine, at Wardner. The erection of a 200-ton mill was started at the Monarch property, east of Murray. The building of 3 new dredges is, in part, evidence of the improvement in this method of placer mining. Only 4 dredges produced considerable amounts of gold, though 4 others were run for short periods. The most productive boat was that of the Moline Mining Company, at Placerville, active since 1905. This company owns 80 acres of ground, said to yield 30 cents per cubic yard. The capacity of the plant is 1,400 cubic yards per day. For four years the Idaho Company, at Pierce, has operated a Risdon dredge capable of treating 1,000 cubic yards per day. The gravel is reported to contain 21 cents per cubic yard. Toward the end of the year another dredge was completed by the same company. This plant has a capacity of 2,000 cubic yards per day. Two new dredges were built at Elk City, one by the Elk City Dredge Company and another by the Jennings Dredge Company.

Those familiar with the Cœur d'Alene region concede that its zenith has been passed. One of the old producers has been abandoned. Probably the most noteworthy event of the season was the development of the Caledonia property, which promises to become an important producer.

Mine production of gold, silver, copper, lead, and zinc in Idaho in 1909, by counties.

County.	Gold.		Silver.		Copper.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Fine ounces.		*Fine ounces.*		*Pounds.*	
Ada	166.99	$3,452	97	$50		
Bannock			14	7	1,396	$181
Bingham	172.17	3,559	15	8		
Blaine	1,954.45	40,402	115,303	59,958	22,740	2,956
Boise	10,450.50	216,031	8,484	4,412	2,185	284
Bonner	24.67	510	26,142	13,594	3,127	407
Canyon	15.29	316	4	2		
Cassia	26.75	553	5	3		
Custer	4,442.95	91,844	11,464	5,961	90,461	11,760
Elmore	9,346.87	193,217	15,777	8,204		
Fremont	7.06	146	1,562	812		
Idaho	9,927.13	205,212	7,421	3,859		
Kootenai and Latah	139.46	2,883	14	7		
Lemhi	6,279.46	129,808	5,675	2,951	46,246	6,012
Lincoln	43.01	889	2	1		
Nez Perce	2,202.17	45,523	516	268		
Oneida	88.82	1,836	5	3		
Owyhee	20,574.13	425,305	647,397	336,646		
Shoshone	4,325.60	89,418	6,201,157	3,224,602	8,906,944	1,157,903
Twin Falls	130.27	2,693	6	3		
Washington	10.89	225	573	298	42,390	5,511
Total	70,328.64	1,453,822	7,041,633	3,661,649	9,115,489	1,185,014

County.	Lead.		Zinc.		Total value.
	Quantity.	Value.	Quantity.	Value.	
	Pounds.		*Pounds.*		
Ada					$3,502
Bannock					188
Bingham					3,567
Blaine	1,762,268	$75,777	71,010	$3,834	182,927
Boise	15,410	663			221,390
Bonner	5,459	235			14,746
Canyon					318
Cassia					556
Custer	81,011	3,483			113,048
Elmore					201,421
Fremont	430,781	18,524			19,482
Idaho					209,071
Kootenai and Latah					2,890
Lemhi	132,071	5,679			144,450
Lincoln					890
Nez Perce					45,791
Oneida					1,839
Owyhee	627	27			761,978
Shoshone	213,558,658	9,183,022	1,280,000	69,120	13,724,065
Twin Falls					2,696
Washington					6,034
Total	215,986,285	9,287,410	1,351,010	72,954	15,660,849

Tonnage of ore sold or treated, number of mines producing, and tenor of ores in Idaho in 1908 and 1909, by counties.

County.	Total tonnage of ore sold or treated.		Deep mines producing.		Total average value per ton.		Average value per ton in gold and silver.		Total value of deep mines.
	1909.	Increase (+) or decrease (−).	1908.	1909.	1908.	1909.	1908.	1909.	
	Short tons.	*Short tons.*							
Ada	99	− 294	4	3	$11.84	$9.75	$11.84	$9.75	$965
Bannock	40	+ 40	....	1	....	4.70	....	.18	188
Bingham	40	+ 33	1	1	50.85	10.70	13.28	10.70	428
Blaine	20,373	+12,620	37	15	18.65	8.97	8.81	4.92	182,808
Boise	8,705	− 7,149	17	17	5.37	8.86	5.33	8.75	77,084
Bonner	199	+ 2	8	4	101.93	74.10	90.80	70.87	14,746
Canyon	....	....	....	....	....	....	....	....	....
Cassia	....	− 10	2	....	90.90	....	59.00	....	....
Custer	15,168	− 3,779	20	13	21.92	7.01	15.73	6.01	106,344
Elmore	56,847	+32,586	12	8	6.24	3.48	6.24	3.48	198,083
Fremont	371	+ 285	3	2	32.94	52.15	2.94	2.22	19,346
Idaho	25,765	+ 9,987	17	17	9.85	7.00	9.84	7.00	180,393
Kootenai and Latah	....	....	....	....	....	....	....	....	....
Lemhi	19,827	+17,312	19	11	31.73	6.07	19.48	5.48	120,324
Lincoln	....	....	....	....	....	....	....	....	....
Nez Perce	169	+ 169	....	2	....	2.39	....	2.39	404
Oneida	....	....	....	....	....	....	....	....	....
Owyhee	55,333	+ 3,842	7	12	16.38	13.74	16.38	13.74	760,259
Shoshone	1,569,332	+17,652	28	27	8.51	8.74	2.22	2.10	13,710,220
Twin Falls	....	....	....	....	....	....	....	....	....
Washington	115	− 141	3	2	65.98	52.47	3.96	4.55	6,034
Total	1,772,383	+83,152	178	135	8.96	8.68	3.03	2.73	15,377,626

Tonnage of milling and smelting ore and concentrates, with metallic contents, produced in Idaho in 1909, by counties.

County.	Concentrates produced.						Total value of concentrates.
	Quantity.	Gold.	Silver.	Copper.	Lead.	Zinc.	
	Short tons.	*Fine ozs.*	*Fine ozs.*	*Pounds.*	*Pounds.*	*Pounds.*	
Ada	2	3.75	39	....	....	....	$98
Bannock	10	....	14	1,396	....	....	188
Bingham	....	....	....	....	....	....	....
Blaine	2,250	1,090.12	55,304	15,224	622,194	54,642	82,977
Boise	787	1,606.41	5,877	2,185	12,777	....	37,097
Bonner	....	....	....	....	....	....	....
Custer	16	343.65	1,135	....	....	....	7,694
Elmore	934	2,222.56	6,849	....	....	....	49,506
Fremont	....	....	....	....	....	....	....
Idaho	292	2,653.08	6,066	....	....	....	57,998
Lemhi	5	57.07	5	48	....	....	1,190
Nez Perce	....	....	....	....	....	....	....
Owyhee	130	2,680.21	358,139	....	554	....	241,661
Shoshone	184,328	2,269.07	4,254,396	919,107	179,223,652	1,280,000	10,154,413
Washington	....	....	....	....	....	....	....
Total	188,754	12,925.92	4,687,824	937,960	179,859,177	1,334,642	10,632,822

Tonnage of milling and smelting ore and concentrates, with metallic contents, produced in Idaho in 1909, by counties—Continued.

County.	Ore to gold and silver mills.			Quantity of ore to concentrating mills.
	Quantity.	Gold in bullion.	Silver in bullion.	
	Short tons.	*Fine ozs.*	*Fine ozs.*	
Ada	99	41.29	26	
Bannock				40
Bingham	40	20.51	8	
Blaine	5,024	34.96	25	3,386
Boise	6,804	1,814.99	713	1,878
Bonner				
Custer	13,624	3,747.76	3,670	
Elmore	56,847	6,963.71	8,894	
Fremont				
Idaho	14,079	5,893.43	1,089	
Lemhi	19,576	5,038.94	602	
Nez Perce	169	19.25	12	
Owyhee	55,317	17,751.66	288,472	
Shoshone	19	9.38	15	1,413,396
Washington				
Total	171,598	41,335.88	303,526	1,418,700

County.	Crude ore to smelters.						Total value.
	Quantity.	Gold.	Silver.	Copper.	Lead.	Zinc.	
	Short tons.	*Fine ozs.*	*Fine ozs.*	*Pounds.*	*Pounds.*	*Pounds.*	
Ada							
Bannock							
Bingham							
Blaine	1,753	823.66	59,972	7,516	1,140,074	16,368	$99,095
Boise	23	87.67	329		2,633		2,096
Bonner	199	24.67	26,142	3,127	5,159		14,746
Custer	1,544	31.20	6,501	90,461	81,011		19,268
Elmore							
Fremont	371	.48	1,562		430,781		19,346
Idaho							
Lemhi	251	19.16	4,957	46,198	132,071		14,657
Nez Perce							
Owyhee	15	60.36	735		73		1,633
Shoshone	136,114	1,380.20	1,946,634	7,987,837	34,335,006		3,555,605
Washington	115	10.89	573	42,390			6,034
Total	140,385	2,438.29	2,047,405	8,177,529	36,127,108	16,368	3,732,480

Subdivision of tonnage of ore sold or treated in Idaho in 1909, by counties, in short tons.

County.	Siliceous ore.	Copper ore.	Lead ore.	Zinc ore.	Lead-zinc ore	Total.
Ada	99					99
Bannock		40				40
Bingham	40					40
Blaine	5,328		4,791		10,254	20,373
Boise	8,705					8,705
Bonner	199					199
Canyon						
Cassia						
Custer	13,624	1,440	104			15,168
Elmore	56,847					56,847
Fremont			371			371
Idaho	25,765					25,765
Kootenai and Latah						
Lemhi	19,576	63	188			19,827
Lincoln						
Nez Perce	169					169
Oneida						
Owyhee	55,333					55,333
Shoshone	49	96,145	1,461,138	12,000		1,569,332
Twin Falls						
Washington		115				115
Total	185,734	97,803	1,466,592	12,000	10,254	1,772,383
Value per ton in gold and silver	$7.86	$3.43	$2.06	$0.16	$1.41	$2.73

Mine production of placer gold in Idaho in 1908 and 1909, by counties.

County.	1908.	1909.
Ada	$1,412	$2,521
Bingham	6,071	3,135
Blaine	1,309	118
Boise	117,808	143,492
Canyon	784	316
Cassia	....	553
Custer	4,705	6,622
Elmore	4,912	3,320
Fremont	....	136
Idaho	42,680	28,540
Kootenai and Latah	4,225	2,883
Lemhi	35,780	24,068
Lincoln	939	889
Nez Perce	45,179	45,125
Oneida	4,412	1,836
Owyhee	1,125	1,693
Shoshone	12,082	13,787
Twin Falls	2,220	2,693
Washington	....	....
Total	285,643	281,727

Gold production of Idaho placers by different methods, 1908 and 1909.

	Hydraulic.[a]	Drift.	Dredge.	Total.
1908 ... fine ounces	10,030.23	53.71	3,734.04	13,817.98
1909 ... do	8,570.31	138.31	4,919.92	13,628.54

[a] Includes sluicings.

In 1909 there were 324 producing properties, of which 135 were deep mines and 189 were placers. The deep mines were classified as follows: Gold, 2; gold and silver, 68; gold, silver, and copper, 9; gold, silver, copper, and lead, 23; gold, silver, and lead, 13; silver and lead, 16; silver and copper, 1; and gold, silver, copper, lead, and zinc, 3.

REVIEW BY COUNTIES.

ADA COUNTY.

Ada County produced gold and silver valued at $3,502, a decrease of $2,579. The Gold Eagle mine, a large producer in past years, was idle during 1909.

Black Hornet district.—At the Ironsides mine a new 20-stamp mill, to be operated by electric power, was erected, and the Three Links Mining Company acquired a 5-stamp mill. Considerable development work was reported from the district in 1909.

Boise River district.—Placer gold was secured from Dry Creek, a tributary of Boise River, north of Boise.

Highland district.—Placer gold was mined from Boise River by small operators, particularly from the Red Rock claim.

McIntyre district.—The Celtic, 5-stamp mill, 7 miles east of Boise, was operated for a short time.

Shaw Mountain district.—A small amount of bullion was sold from tests made in the 25-ton mill of the Big Giant Mining Company.

BANNOCK COUNTY.

Fort Hall district.—At the Fort Hall mine, a low-grade copper property, a small concentration mill was erected, and trial shipments were made.

BEAR LAKE COUNTY.

Only development work was reported from Bear Lake County in 1909.

BINGHAM COUNTY.

Gold and silver valued at $3,567 was produced from placers in Bingham County. This is a decrease of $2,867.

Mount Pisgah district.—Exceedingly fine gold was, as usual, produced from the property of the American Hydraulic Placer Mining Company and the Barnes group. The Pittsburg Mining Company shipped a small amount of bullion from quartz operations.

Snake River district.—From along Snake River, near Yuma and Blackfoot, several operators shipped placer dust, valued at $1,448.

BLAINE COUNTY.

Mine production of gold, silver, and associated metals in Blaine County, Idaho, in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
DEEP MINES.						
Gold.....................fine ounces..	63.91	$1,321	1,948.74	$40,284	+1,884.84	+$38,963
Silver.............................do....	126,315	66,947	115,301	59,957	− 11,014	− 6,990
Copper......................pounds..	31,941	4,216	22,740	2,956	− 9,201	− 1,260
Lead...............................do....	1,675,124	70,355	1,762,268	75,777	+ 87,144	+ 5,422
Zinc...............................do....	37,410	1,758	71,010	3,834	+ 33,600	+ 2,076
PLACERS.						
Gold.....................fine ounces..	63.32	1,309	5.71	118	− 57.61	− 1,191
Silver.............................do....	11	6	2	1	− 9	− 5
Total..............................	....	145,912	....	182,927	....	+ 37,015

Source of gold and silver in Blaine County, Idaho, in 1908 and 1909, by kinds of ore, in fine ounces.

Metal.	Year.	Placers.	Siliceous ore.	Lead ore.	Copper ore.	Lead-zinc ore.	Total.
Gold..............................	1908	63.32	7.07	56.36	0.48	....	127.23
	1909	5.71	1,564.10	363.19	....	21.45	1,954.45
Silver..............................	1908	11	852	125,463	....	....	126,326
	1909	2	6,980	81,411	....	26,910	115,303

From 15 deep mines in Blaine County 20,373 tons of ore were mined, 1,753 tons of which were shipped crude, 5,024 tons were treated in gold and silver mills, and the remainder, largely tailings, was milled to make 2,250 tons of concentrates. Concentrates had a total value of $82,977 and crude ore of $99,095. There were five concentrating plants operated during the year, but not one did continuous work. A large part of the gold was derived from siliceous ore from the Croesus mine, but most of the silver had its source in lead ore or in lead-zinc ore.

Dome district.—Shipments of lead-silver ore were continued from the Wilbert mines on Little Lost River, near Arco. A shipment was also made from the Fallert property.

Little Smoky district.—Development of the Cannon Ball mine was continued, and a new 10-stamp mill, with amalgamation plates and concentration tables, was erected.

Little Wood River district.—At the Muldoon mine the initial run of the new 120-ton concentration mill was made during August, when lead concentrate was shipped to the Salt Lake smelters. The mill was operated by the hydro-electric power plant owned by the company. There is a wagon haul of nearly 26 miles between Muldoon and Bellevue, and continuous shipping throughout the year is impossible on account of the condition of the road. In the same locality the Mutual and the Garfield properties were under development.

Mineral Hill district.—The output of the district amounted to $39,942 in gold, 103,292 ounces of silver, 22,223 pounds of copper, 1,328,913 pounds of lead, and some zinc. A shipment of rich lead-silver ore was made from the Comet group. The Croesus 100-ton amalgamation and concentration mill was operated, and gold and silver concentrates, as well as crude lead ore and first-class gold ore, were shipped. Ore is taken from two veins, one of galena and one of pyrite, and is said to yield $65 in gold per ton. The Eureka Development Company shipped considerable lead concentrate to Salt Lake smelters. Both the wet and dry sections of the Idaho Consolidated mill were run on tailings, and the resulting lead and zinc concentrates were shipped. The work of unwatering the Minnie Moore mine was continued to the 1,000-foot level. From the Nay-Aug mine was shipped hand-sorted ore to Colorado plants. This mine was first in the district in output of lead and silver. Small shipments were made from the Red Elephant, the Bullion, the Climax, and the Jay Gould mines.

Skeleton Creek district.—At the Frazier mine, on Skeleton Creek, 31 miles northwest of Soldier and 12 miles from Atlanta, considerable work was done. The ore occurs in a fissure in granite.

Soldier district.—Development work was done on a gold property near Soldier.

Warm Springs district.—The Boston-Idaho Mining Company started the construction of a 100-ton concentration plant. The North Star mine produced lead ore and zinc ore.

BOISE COUNTY.

Mine production of gold, silver, and associated metals in Boise County, Idaho, in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
DEEP MINES.						
Gold.....fine ounces..	3,942.51	$81,499	3,509.07	$72,539	− 433.44	−$8,960
Silver.....do....	5,756	3,050	6,919	3,598	+ 1,163	+ 548
Copper.....pounds..	198	26	2,185	284	+ 1,987	+ 258
Lead.....do....	13,596	571	15,410	663	+ 1,814	+ 92
PLACERS.						
Gold.....fine ounces..	5,698.96	117,808	6,941.43	143,492	+1,242.47	+25,684
Silver.....do....	1,273	675	1,565	814	+ 292	+ 139
Total.....	.....	203,629	.....	221,390	.....	+17,761

Source of gold and silver in Boise County, Idaho, in 1908 and 1909, by kinds of ore, in fine ounces.

Metal.	Year.	Placers.	Siliceous ore.	Total.
Gold	1908	5,698.94	3,942.53	9,641.47
	1909	6,941.43	3,509.07	10,450.50
Silver	1908	1,273	5,756	7,029
	1909	1,565	6,919	8,484

Gold is the most important metal produced in Boise County, and although production decreased slightly from deep mines it increased materially from placers, probably due to dredging operations near Idaho City. There were 65 producing properties in the county, including 46 hydraulic placers and 2 dredges. The ore treated was 8,705 tons, or little more than half of that of 1908, but there was a corresponding increase in value per ton, from $5.37 to $8.86. Of this ore 6,804 tons were treated in 10 gold and silver mills, making $37,519 in gold bullion. The concentrates, 787 tons, were valued at $37,097, and half of them, or 395 tons, were derived from amalgamation mills having concentrators.

Boise Basin region.—This region, embracing property in the vicinity of Idaho City, Placerville, Pioneerville, and Centerville, produced gold valued at $175,852, 4,478 ounces of silver, and a little copper and lead, in all valued at $178,310. There were 9 deep mines and 39 placers, and 5 gold mills in operation. The largest placer producers were: Moline Mining Company, Boston and Idaho Gold Dredging Company, Boise Basin Hydraulic and Placer Company, Basin Branch placer, Harwood Glen Gold Mining Company, M. Leary placer, Oaks Mining Company, Grimes Pass Placer Mining Company, Globe Mines Exploration Company, Barker placer, and High Five. The Moline Mining Company, operating near Placerville, remained the largest placer gold producer of this region. The company has successfully operated a floating dredge for the last four years on gravel said to be 30 feet deep and averaging 30 cents per cubic yard. The property comprises 80 acres, and the boat, which has a capacity of 1,400 cubic yards per day, is active about eight months of the year. The Boston-Idaho Gold Dredging Company made a large output from a dredge of 2,000 cubic yards capacity below Idaho City. The plant is run by electric power generated on the Payette River. An additional dredge of greater capacity is to be built. Hydraulic giants are used on other properties. The White Quartz Mining Company, owning the Elkmeat and Lincoln quartz mines, has acquired considerable placer ground, including the Man and Hanson property. It is planned to develop more water and to work this deposit on a large scale. The Golden Age Mining Company, near Pioneerville, operated a 5-stamp mill, but shipped more bullion than any other quartz operator in the locality. Concentrate was also marketed. Bullion was shipped through the running of the Sunday mill on old fillings from the Confederate mine of the Gold Hill and Iowa Mines Company. This company will operate a 20-stamp mill by the use of power from the Boston-Idaho electric power plant on the Payette River. A new 50-ton Chilean mill was completed during the year and bullion shipped through the operation of the old 5-stamp mill. From the Belshazzar mine, west of Quartzburg, some bullion was shipped early in the year. An old 10-stamp mill from the Iowa mine was used in 1908. The Edna Mines Company built an 80-ton cyanide mill to reduce ore from a deposit of silver chloride 20 miles north of Idaho City.

Deadwood Basin district.—The Merry Blue and the Union mines produced a small amount of bullion from ore treated in an arrastre.

Highland Valley district.—The Highland Valley Power Company produced from placers on Boise River near the Highland Dam.

Payette River district.—Small lots of placer dust were sold from points on Payette River.

Boise River district.—Gold dust valued at $1,375 came from near Twin Springs and the north bank of the Boise River.

Summit Flat district.—A small Tremain mill on the Black Jack mine turned out some bullion.

West View district.—The production of this district was gold valued at $33,900, 3,905 ounces of silver, 1,737 pounds of copper, and 13,745 pounds of lead, in all valued at $36,748. The Lincoln mine at Pearl, formerly a large producer, was merely productive through lessees, some bullion and concentrates having been shipped. The largest producer of the district was the Leviathan mine. The ore contains principally gold and silver, with small amounts of copper, lead, and zinc. A small mill was in operation making concentrate, which was hauled 10 miles to Emmett on the Oregon Short Line Railroad. The Lavan Group produced bullion and concentrate. The Gold Eagle mine, near Horseshoe Bend, produced a small lot of bullion.

BONNER COUNTY.

The county produced gold valued at $510, 26,142 ounces of silver, 3,127 pounds of copper, and 5,459 pounds of lead, the total output being valued at $14,746. This production came entirely from four mines in the Pend d'Oreille district, from which were shipped 199 tons of siliceous ore, principally valuable for its silver.

Cœur d'Alene district.—East of Clark Fork, on the Great Northern Railroad and extending along the Montana State line, is a new district called Cœur d'Alene—not to be confused with the famous Cœur d'Alene region of Shoshone County. The St. Lawrence mine on Antelope Mountain, 1½ miles from Clark Fork, was worked. The ore is galena.

Pend Oreille district.—The Ponderay smelter, belonging to the Idaho Smelting and Refining Company, was operated until the middle of March, after which the plant was closed. Operators of mines around Lake Pend Oreille did comparatively little shipping. The Little Joe mine at Blacktail, the Katherine, and the Wisconsin were producers.

Lakeview district.—Although several of the mines of this locality are said to have ore blocked out, no shipments were made during 1909.

Priest Lake district.—No ore was shipped from this district in 1909, largely from lack of railroad facilities.

CANYON COUNTY.

Only placer gold in small quantity was taken from Boise, Payette, and Snake rivers.

CASSIA COUNTY.

With the exception of the production of small amounts of gold from Snake River the county was unproductive.

CUSTER COUNTY.

Custer County yielded an exceptionally small production in 1909, since neither the Lost Packer smelter at Ivers nor the Empire Copper Company's plant at Mackay were operated. Production amounted to 15,168 tons of ore, which yielded $91,844 in gold, 11,464 ounces of silver, 90,461 pounds of copper, and 81,011 pounds of lead, all metals valued at $113,048. This production included placer gold, valued at $6,622, and 158 ounces of silver. There were 21 mines, of which 8 were placers. Gold came almost entirely from siliceous ore.

Alder Creek district.—Small shipments of ore were made from the Black Daisy, White Knob, Silver King, and Homestake mines.

Bayhorse district.—The principal mines of the district remained idle, awaiting the building of a railroad. As in former years, lessees shipped rich lead-silver ore from the South Butte, Forest Rose, Cave, and Turtle mines.

Loon Creek district.—On account of the excessive cost of hauling matte, coke, and supplies and the prospect of better transportation by new wagon road and by railroad being surveyed down Salmon River, the Lost Packer Mining Company, whose property is 120 miles west of Mackay, confined its efforts to the development of the mine. The 100-ton smelter, which produced much matte, rich in gold, silver, and copper, in 1908, was idle.

Sea Foam district.—The Greyhound Mining and Milling Company, 40 miles north of Stanley, equipped its property near Idaho County with a 10-stamp mill.

Stanley Basin district.—From 1 deep mine and 7 placers the district produced $15,551 in gold and 674 ounces of silver. The Valley Creek mine produced bullion the latter half of the year through the operation of the 10-stamp mill. The bullion is about half gold and half silver, like that of the Golden Sunbeam, and the ore is somewhat refractory. The Joe's Gulch, Challis and Sturkey, and Martini placers were productive. In 1908 a small dredge was built by the Idanha Dredge Company. This company was succeeded by the Stanley Dredge Company, which produced no gold in 1909. The old dredge operated by the Stanley Dredging Company was not worked profitably in 1909, and it was planned by the successor, the Willis Company, to build new dredge equipment.

Yankee Fork district.—The Golden Sunbeam mine and adjoining property was the largest producer of the county. The company was engaged in building a dam on Salmon River, at Yankee Fork, 12 miles from Sunbeam, to generate electricity for power. At least 1,000 horsepower will be available, and other mines of the county, such as the Lost Packer, may be benefited.

ELMORE COUNTY.

Elmore County was only exceeded in gold output by Boise, Idaho, and Owyhee counties. Production was $193,217 in gold and 15,777 ounces of silver, valued at $8,204. There were substantial increases in both metals. There were 6 gold and silver mills in operation, but only 3 were operated regularly. With the exception of some placer product, the gold and silver came from siliceous ore. Concentrates from gold and silver mills, amounting to 934 tons, produced 2,222.56 ounces of gold and 6,849 ounces of silver.

Bear Creek district.—Production amounted to $545 in gold and silver.

Black Warrior district.—Only a nominal production of gold was made in the Black Warrior district, 12 miles north of Atlanta.

Highland district.—From near Twin Springs on the south side of Boise River placer gold was won in small amounts.

Middle Boise district.—From 3 deep mines 55,390 tons of ore were treated by amalgamation, concentration, and cyanide. The product, including placer gold, was valued at $183,374. The Minerva and Pettit mines were the largest producers. A small shipment of bullion in 1909 was made from mill tests at the Monarch in 1908. The 10-stamp mill of the Minerva mines is equipped with amalgamation and concentration tables. Most of the contents of the ore was won by amalgamation. Rich concentrate was shipped to Salt Lake smelters. The Pettit mine of the Bagdad-Chase Gold Mining Company was operated throughout the year and greatly increased its bullion output. The mine is south of Atlanta and like the Monarch has part of the Atlanta lode. More than three-fifths of the value of the gold and silver was won by amalgamation. The remainder was in the concentrate, which was first roasted and then cyanided. The mill, half of which was new in 1908, consists of 40 stamps and a 150-ton cyanide plant. The camp is over 80 miles from Boise, and 60 men were employed. West of Atlanta the Boise King placers, comprising 640 acres, were being prepared for operation by hydraulicking. A little gold was washed from them and the Idaho Bonanza ground.

Neal district.—At the Homestake mine 30 men were employed doing development work and milling ore said to average $5 per ton in gold and silver. Bullion and concentrates were shipped through the operation of the 10-stamp mill.

Pine Grove district.—The C. H. Gold Mining Company was interrupted in production in 1908 by the burning of its 10-stamp mill and cyanide plant. A new 5-stamp mill was erected in 1909. A small amount of bullion was shipped, but less than in past years.

Snake and Boise rivers.—Placer gold came from the Lucky Boy, near Twin Springs, and from Snake River gravel near Glenns Ferry.

FREMONT COUNTY.

The value of the output of Fremont County was $19,482 from lead ore and slight placer gold.

Unorganized district.—Near Black Butte, 4 miles from Birch Creek, in the western part of the county, the Scott mine was operated by the Birch Creek Mining Company. Shipments were made of ore unusually rich in lead, but containing little silver.

IDAHO COUNTY.

Mine production of gold, silver, and associated metals in Idaho County, Idaho, in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
DEEP MINES.						
Gold....................fine ounces..	7,268.54	$150,254	8,546.51	$176,672	+1,277.97	+$26,418
Silver..........................do....	9,568	5,071	7,155	3,721	− 2,413	− 1,350
Copper....................pounds..	233	31	....	....	− 233	− 31
PLACERS.						
Gold....................fine ounces..	2,064.64	42,680	1,380.62	28,540	− 684.02	− 14,140
Silver..........................do....	339	180	266	138	− 73	− 42
Total..............................	....	198,216	....	209,071	....	+ 10,855

There were 9 mills in operation in Idaho County in 1909, all of which used amalgamation, 2 used concentration, and 1 the cyanide process. As these mills were worked only for short periods, only 25,765 tons of ore were treated. There were 57 producing properties, including 40 placers. These mines produced gold valued at $205,212 and 7,421 ounces of silver, valued at $3,859, an increase of $12,278 in gold. The county ranked third as a gold producer, nearly 16 per cent of the gold product being derived from placers and the remainder from siliceous ore.

Big Creek district.—Bullion was shipped from the Moscow mine, ore being run through a single-stamp mill.

Dixie district.—The Diamond Consolidated Mines Company made mill tests with an old 4-stamp mill. Placer gold was taken from the Bentley and Eakin mines.

Elk City district.—From 9 placers and 3 deep mines the district produced $174,036 in gold and 7,069 ounces of silver. Placer producers were the Golden Rule, Gold Hill, Erickson, and Bed Rock mines. At the intersection of American River and Elk Creek two new Hammond dredges were built, but not operated before cold weather prevented work. The first was for the Elk City Dredging Company, on American River, and the second for the Jennings Dredging Company, on Little Elk Creek. The Buster mine was the largest producer of the county. A 10-stamp mill and 40-ton cyanide plant were operated until November, when work ceased. Bullion was shipped for eleven months, and concentrate and precipitate were sent to Tacoma. The American Eagle group was only productive in a small way through lessees. The South Fork mine, 8 miles from Elk City, was an important producer the last half of the year. A large amount of work was done on many other properties in the district.

Florence district.—A small amount of placer gold was taken out of the Buttercup and Dayton placers.

Marshall Lake district.—The Goodenough mine, which produced bullion in 1907, remained idle, and the Mount Marshall Mining Company, which erected a 6-stamp Merritt mill in 1907 and did much development, has produced nothing.

Newsome district.—Three deep mines and 5 placers produced gold valued at $6,272 and 41 ounces of silver. The Newsome and Leggett Creek placers were operated, but produced little. The Old Montana placers consist of 750 acres of gravel, which is said to average 10 cents per cubic yard. Preparations for operations on a large scale were in progress. Four hydraulic giants are on the ground. The Iron Crown produced bullion from a 6-ton amalgamation mill.

Orogrande district.—Development and mill construction only were done in this district in 1909. Progress was made at the Twin Buttes mine, which is equipped with a 50-ton Chilian mill. A cyanide plant and tramway were added in 1909.

Robbins district.—The Cracker Jack, in the Buffalo Hump country, 75 miles from Stites, was acquired by the Mines Company (Limited), of Spokane, and a small production was made in testing ore. The old 10-stamp mill was operated part of the year before being dismantled and replaced by a new 20-stamp mill. The Jumbo mine was idle.

Simpson district.—Gold valued at $3,152 and 15 ounces of silver came from Lucile, from the Cave, Great Nugget, and Dandy mines on Salmon River.

Salmon River district.—From this district, which adjoins the Simpson district on the north, and from points near Salmon River, $2,585 in gold and 16 ounces of silver were mined from the Monarch, Malone, Horseshoe Bend, and Burgund placers.

Thunder Mountain district.—There was a production of $2,439 in placer gold dust from Thunder Mountain district in 1909. The Venable Bonding and Leasing Company treated a small amount of ore.

Warren district.—The production of Warren district was $8,728 in gold and 116 ounces of silver. The Gott, Golden Rule, Rigdon, and Shissler Creek mines were producing placers. The Golden Rule mine greatly decreased its output. The White Monument, Little Giant, Skylark, and Waln mines were quartz producers.

KOOTENAI AND LATAH COUNTIES.

Production from these counties consisted of placer gold and silver valued at $2,890 from properties at Tyson and in the Hoodoo and Gold Creek districts. Sluicing operations were carried on by the Cedar Creek Mining Company at Tyson, and the Annie placer, at Harvard, had a fair production.

LEMHI COUNTY.

Mine production of gold, silver, and associated metals in Lemhi County, Idaho, in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity	Value.	Quantity	Value.
DEEP MINES.						
Gold..................fine ounces..	1,785.13	$36,902	5,115.17	$105,740	+3,330.04	+$68,838
Silver..........................do....	22,825	12,098	5,564	2,893	− 17,261	− 9,205
Copper...................pounds..	10,366	1,368	46,246	6,012	+ 35,880	+ 4,644
Lead..........................do....	700,622	29,426	132,071	5,679	− 568,551	− 23,747
PLACERS.						
Gold..................fine ounces..	1,730.88	35,780	1,164.29	24,068	− 566.59	− 11,712
Silver..........................do....	167	88	111	58	− 56	− 30
Total..............................	....	115,662	....	144,450	....	+ 28,788

Source of gold and silver in Lemhi County, Idaho, in 1908 and 1909, by kinds of ore, in fine ounces.

Metal.	Year.	Placers.	Siliceous ore.	Lead ore.	Copper ore.	Copper-lead ore.	Total.
Gold	1908	1,730.88	1,775.06	9.00	0.65	0.42	3,516.01
	1909	1,164.29	5,096.04	4.03	15.10	....	6,279.46
Silver	1908	167	1,055	21,264	30	476	22,992
	1909	111	607	3,279	1,678	....	5,675

The output of the county, which was below normal on account of the idleness of the lead properties at Gilmore, was 19,827 tons of ore, gold valued at $129,808, 5,675 ounces of silver, 46,246 pounds of copper, and 132,071 pounds of lead, the total value being $144,450. In 1905 and 1906, when the Gilmore mine was producing, the county total value was over $200,000, almost equally divided between the gold and the lead-silver ore. Although placers fell short of the output of 1908, gold production from deep mines increased materially, especially from the Kittie Burton and the Ulysses mines. There were 17 productive properties, including 5 placers and 1 dredge. Over 98 per cent of the ore was treated in 5 gold and silver mills. At the close of the year the Gilmore and Pittsburg Railroad Company (Limited), from Armstead, Mont., had rails laid from Armstead to a point within the Idaho line. There will be an improvement in the production of lead when trains are in operation from Salmon and Gilmore. The road traverses the divide at Bannock Pass and will run southwest to Leadore, which is 20 miles north of Gilmore, and thence northwest 50 miles to Salmon. A branch from Leadore to Gilmore will be constructed. Surveys for further railroad location have extended up Salmon River, thence toward Boise and down to Lewiston.

Eldorado district.—The Bohannon Bar placers were operated by the hydraulic method, but were not as productive as formerly.

Gravel Range district.—Development was done south of Forney, 38 miles southwest of Salmon, on the Rabbit Foot mine.

Gibbonsville district.—The American Development, Mining and Reduction Company operated a 20-stamp mill and cyanide plant and shipped more bullion than during any year since 1902. The Anderson mine also marketed bullion from a 15-ton mill.

Indian Creek district.—The Kittie Burton and the Ulysses mines on Indian Creek, 40 miles northwest of Salmon, were the most productive mines of the county. The mill consists of 15 stamps and concentrators. Rich concentrate was shipped to Utah, and bullion shipments were made.

Junction district.—The Junction Mines Company, a silver-lead shipper, 50 miles southeast of Salmon, was awaiting the advent of the railroad to Salmon. The mine is opened by shaft 217 feet and by tunnels.

Mackinaw district.—Only placer gold in small quantity was taken from this locality.

The Richardson placer was operated by the hydraulic method and produced gold.

The Mullan dredge on Moore Creek produced considerable fine bullion during the year. The Queen mine, 6 miles from Salmon, was equipped with a 50-ton, 15-stamp mill, from which bullion was shipped from May to the end of the year. The plant is driven by electricity and is equipped with amalgamation plates and concentration tables. The ore is largely free milling.

Mineral Hill district.—At Shoup work was done on the Clipper Bullion and Panata claims.

Spring Mountain district.—At Hahn, in the Spring Mountain district, the 80-ton lead smelter of the Lemhi Smelting Company had its initial run on ore from the Lemhi Union mine. After this ten-day test the plant was closed. This mine also supplied ore to plants outside the State.

Texas district.—At Gilmore the Pittsburg-Idaho Mining Company, which for many years was the largest lead-ore shipper in the county, was nonproductive, awaiting the building of the railroad from Armstead. The shipping ore, according to published statements, assays about 33 per cent lead, 18 ounces silver, and 60 cents in gold per ton. The Latest Out mine, whose ore is similar to that of the Pittsburg-Idaho property, produced several carloads of ore.

McDevitt district.—The Copper Queen copper mine, located 35 miles south of Salmon on Agency Creek, produced some rich bornite ore.

Yellow Jacket district.—The Yellow Jacket mine, which several years ago was equipped with a large stamp mill, was purchased by a new company and will be opened in the spring.

LINCOLN COUNTY.

Snake River district.—Placer gold valued at $890 was taken from the Snake River near Clear Lake.

NEZ PERCE COUNTY.

Production of gold, almost entirely that of placers, was valued at $45,523, a slight increase over that of 1908.

Burnt Creek district.—Gold valued at $2,133 was taken from the Boise, Daylight, Wendall, and Cranberry Creek placers.

Pierce district.—The gold output was valued at $43,390. The Idaho Company (Limited), was, as in past years, the largest placer producer of the county. For four years a dredge of a capacity of 1,000 cubic yards has worked gravel, said to average about 20 cents per cubic yard. Much of the material worked is tailing from previous placer operations. In 1909 a new dredge with double the capacity of the old one was constructed and ready for service in December. For several years the annual placer production of Pierce district has been about 2,000 fine ounces of gold. With the new dredge the output should be greatly increased. The other important hydraulic operators of the district either used or are adopting Ruble elevators. Among these are the American Placer Mining Company, the Orogrande Placer Mining Company, the Rich Hill Water and Mining Company, and the Rhodes Creek Mining Company. No production of consequence was made from quartz mining.

ONEIDA COUNTY.

Snake River district.—Near Neeley, on Snake River, the Sorensen was again the largest placer producer; others were the Rosecranz and the Bonanza Bar. Production was valued at $1,839.

OWYHEE COUNTY.

Nearly 30 per cent of the State's gold output was secured from the camps of Owyhee County. The production was gold, valued at $425,305, and 647,397 ounces of silver, which with a little lead yielded a total value of $761,978. This represented an increase of $35,389 in gold and a decrease of 210,140 ounces in silver. With the exception of a small placer production the gold and silver was from siliceous ore. There were 55,333 tons of ore shipped and treated, which, with the exception of 15 tons shipped direct, was treated in 6 gold and silver mills. There were 15 producing properties, of which 3 were placers. The value of the ore per ton has been gradually decreasing—from $18.70 in 1907 to $16.38 in 1908 and to $13.74 in 1909. Concentrates from gold and silver mills amounted to 130 tons and contained $55,835 in gold, 358,139 ounces of silver, and 554 pounds of lead.

Carson district.—The production of Carson district, which was nearly that of the county, was 55,029 tons of ore, $424,237 in gold and 642,299 ounces of silver. This district has for many years produced more gold than any other district in the State. Aside from the output of the Trade Dollar and the De Lamar mines there was little output. In 1909 the Trade Dollar Consolidated Mining Company operated its 20-stamp mill and shipped much bullion to Omaha for refining. The developed ore reserves were said to be exhausted, and for a time the mill was run on the filling from old stopes. Development consists of many miles of underground work. In the De Lamar section of the Carson district the 150-ton mill of the De Lamar Company (Limited) was operated as usual, turning out bullion which has a fineness of about 0.925 silver and 0.060 gold. The property has 15 miles of underground work, 7,273 feet of openings having been accomplished in 1909. Dividends declared that year were $38,700. From the Burro, Homestake, Neversweat, Pauper, Good Hope, and Potosi mines small lots of bullion were shipped. The Good Hope is a placer. The Banner Mining and Milling Company made a trial shipment. At this mine a tramway was built from the mouth of the upper tunnel to the mill, which consists of 4 Nissen stamps with amalgamation and concentration equipment.

Flint district.—Work was done on the old Perseverance property in unwatering the mine and repairing the mill, but no output was reported. The Aurida made a small production.

Castle Creek district.—On Castle Creek, about 20 miles south of Oreana, the Golden Crown Mining Company erected and operated a 3-stamp mill equipped with a Pinder concentrator. Some bullion and concentrate were marketed.

Snake River district.—From the Meadow Creek placer some of the fine Snake River gold was sold.

SHOSHONE COUNTY.

Mine production of gold, silver, and associated metals in Shoshone County, Idaho, in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
DEEP MINES.						
Gold.......fine ounces..	3,293.61	$68,085	3,658.65	$75,631	+ 365.04	+ $7,546
Silver............do....	6,364,454	3,373,160	6,201,045	3,224,544	− 163,409	−148,616
Copper........pounds..	9,042,876	1,193,660	8,906,944	1,157,903	− 135,932	− 35,757
Lead.............do....	204,138,418	8,573,814	213,558,658	9,183,022	+9,420,240	+609,208
Zinc..............do....	....	....	1,280,000	69,120	+1,280,000	+ 69,120
PLACERS.						
Gold.......fine ounces..	584.47	12,082	666.95	13,787	+ 82.48	+ 1,705
Silver............do....	98	52	112	58	+ 14	+ 6
Total............	....	13,220,853	....	13,724,065	....	+503,212

Source of gold and silver in Shoshone County, Idaho, in 1908 and 1909, by kinds of ore, in fine ounces.

Metal.	Year.	Placers.	Siliceous ore.	Copper ore.	Lead ore.	Zinc ore.	Total.
Gold........................	1908	584.47	650.69	300.18	2,342.74	....	3,878.08
	1909	666.95	39.38	1,124.96	2,494.31	....	4,325.60
Silver........................	1908	98	374	607,553	5,756,527	....	6,364,552
	1909	112	76	594,824	5,602,395	3,750	6,201,157

Although Shoshone County has a relatively small gold output, it takes first rank in production of silver, copper, lead, and zinc. Lead production is again increasing, but silver and copper production, on the contrary, are on the decrease. The output of zinc ore will, in all probability, increase. The crude-ore output of 1909, amounting to 1,569,332 tons, increased about 1 per cent, and its total value per ton was $8.74, against $8.51 in 1908. The value per ton in gold and silver decreased slightly, from $2.22 to $2.10. Of the tonnage given above, 136,114 tons were shipped direct to smelters as first-class ore, which contained $28,531 in gold, 1,946,634 ounces of silver, 7,987,837 pounds of copper, and 34,335,006 pounds of lead, or a total value of $3,555,605. There were 14 concentration plants, which had a combined capacity of 6,650 tons per day. A few of these, however, were active only a small part of the year. In these plants 1,413,396 tons of ore were reduced to 184,328 tons of concentrate, which yielded metals valued at $10,154,413, or $55.09 per ton. The greatest part of both the gold and silver has its source in the lead ore.

Beaver district.—The district extends along Beaver and Trail creeks, in the northern part of the Cœur d'Alene region. One deep mine and 8 placers were productive. Placer production was $10,501 in gold. The Black Hill ground was most productive. Other producers were Gilbert, Bird, Fehling, Horseshoe, Myrtle, New Year, Frost, and Orphan Child mines. The Callahan mine, on Sunset Peak, was a producer of ore containing 35 ounces of silver and over

60 per cent lead per ton. Other deep mines in operation were the Idora, Clear Grit, Nipsic, Diamond Joe, New York, and Potocie. The Potocie Mining Company, which was opening free-milling ore, erected a 2-stamp Nissen mill in November.

Cœur d'Alene district.—Gold dust was sold from the Grove and Walker placers.

Eagle district.—The Eagle placer produced much coarse gold. The Orofino mines, 7 miles east of Murray, produced lead ore.

Evolution district.—Lead and copper ore shipped was valued at $4,593.

Hunter district.—This locality comprises ground in the eastern part of the Cœur d'Alene region, famous through the production of the Morning, Snow Storm, and Gold Hunter mines. The district produced 522,522 tons of ore, $33,277 in gold, 1,234,510 ounces of silver, 7,986,601 pounds of copper, and 34,373,033 pounds of lead, in all valued at $3,191,520. The Alice mine was added to the list of producers in 1909. The operators of this mine, owning 23 claims on Ruddy Gulch, between Wallace and Mullan, erected a 100-ton mill and began the shipment of concentrate in November. The Federal Mining and Smelting Company, which operated mines at Mullan, Mace, and Wardner, declared dividends of $840,000 on the preferred and $90,000 on the common stock. The company is the most extensive operator in the county, controlling four of the largest mines. In this district the company owns the Morning mine, 2 miles north of Mullan. Both the Morning and You Like veins are opened at great depth by No. 6 tunnel, which is nearly 2 miles long. In past years, production from these two veins averaged about 26,000,000 pounds of lead and 500,000 ounces of silver per year. Ore from the You Like contained about 30 ounces of silver per ton, but that from the Morning averaged only 15 ounces. As a large percentage of silver and lead was lost in concentration, experiments, which were reported successful, were made with the Hancock jig, which has a capacity of about 400 tons per day. Four of these jigs will replace 50 of the old type. Preparations were made for sinking a 4-compartment shaft from the No. 6 tunnel level, which is about 2,200 feet lower than level No. 1. According to report made to the county assessor, 359,700 tons of ore were extracted, having a gross value of $1,277,997. Cost of extraction was $740,576; transportation, reduction, and sale, $543,982; betterments and repairs, $52,261; total operation, $1,336,820; and net loss, $58,822. During the year 2,390 feet of work was done. The Snow Storm Mining Company produced, according to published statements, 7,668,484 pounds of copper and 576,674 ounces of silver in 1909. This is somewhat less than the production of 1908, but more than that of 1907. Dividends amounting to $225,000 were declared. The ore, which is used as a flux, contained 4½ per cent copper, 6.2 ounces of silver, and 90 per cent silica. It was shipped to various smelters, including Anaconda, Tacoma, Granby, Colusa Parrot, Balaklala, and American Smelting and Refining Company plants. No. 4 crosscut has been driven a distance of 3,296 feet, but the vein had not been encountered. The leaching plant remained idle. The assessor's figures gave 96,099 tons extracted; gross yield, $973,861; cost of extraction, $186,029; transportation, $382,545; reduction, $188,732; betterments, $46,589; and net profits, $169,966. Development work aggregating 2,972 feet was done during the year. The

Gold Hunter Mining and Smelting Company, whose property is 1 mile east of Mullan, shipped more concentrate in 1909 than at any previous time in its history. Owing to various repairs, the mill was not operated the entire year. The lowest tunnel has a length of 4,381 feet, and has cut 6 ore bodies, varying in width from several inches to 20 feet. The ore of a new body below the tunnel, similar to that found in the Morning mine, contains only from 5 to 10 ounces of silver per ton. In addition to this drawback, the loss in concentration due to sliming, reaches 50 per cent, which is a higher loss by 20 per cent than that of the mines of Burke and Wardner. The mill has a capacity of 300 tons. East of Mullan, on Gentle Annie Gulch, the Butte and Cœur d'Alene Mining Company has ore containing silver, copper, and lead. There were many other properties in the district on which much development work was done during the year. There are 30 or more which have been opened to the extent of 1,000 feet. Some of those more extensively developed are the Reindeer, Missoula Copper, Carney Copper, Lucky Calumet, and Copper Queen mines.

Lelande district.—The second largest producing district in the county and State was Lelande district, which includes mines at Burke, Mace, and Gem. There were 475,197 tons of crude ore mined, which produced gold valued at $19,119, 2,927,041 ounces of silver, 432,428 pounds of copper, and 77,305,011 pounds of lead, valued in all at $4,921,512. This is a decrease from the shipments of 1908, since the Tiger-Poorman was dropped from the list. Of this ore, 27,296 tons were shipped crude and 446,923 tons were reduced to 53,709 tons of concentrates. From 1902 to 1906, the district's output increased from 53,000,000 pounds of lead and 2,500,000 ounces of silver to 108,000,000 pounds of lead and 4,500,000 ounces of silver. It has since gradually decreased as the output given above shows. The Standard Mammoth, or Mace mines, of the Federal Mining and Smelting Company, the largest producers after the Bunker Hill and Sullivan, were operated without interruption during the year. The assessor's report gives 262,577 tons extracted, with a gross value of $2,124,920. The cost of extraction was $930,048, transportation, reduction, and sale, $688,115, construction and repairs, $37,600, and net profit, $469,155. The shaft was down to the 1,850-foot level, and 2,700 feet of work was done. The Frisco group, 1½ miles east of Gem, was operated spasmodically by lessees. The Hecla mine, at Burke, was active during the year and produced more lead than during any other year of its history. The county report gives 131,097 tons extracted, having a total value of $946,786. Costs were, extraction, $399,066; transportation, reduction, and sale, $330,366; and betterments and repairs, $28,184. The net profit was $189,169. The shaft was sunk 335 feet and 1,110 feet of work was done in tunnel and drift. Dividends totaling $200,000 were declared. The Hercules mine, 2 miles north of Burke, had a slightly decreased output on account of the destruction by fire of the 300-ton milling plant in September. Previous to this misfortune the mine was making an unusual record, as it was said to have produced during August 2,700 tons of crude ore and concentrate. Crude ore alone was shipped during September and October, and in November the Tiger mill was leased and operated by electricity. The annual report to the assessor gives 17,950 tons of concentrate and crude ore shipped direct. The amount of crude ore concentrated is not reported. The output had a gross value of $1,059,036. Cost of extraction was $192,901, transportation, $128,231; reduction and sale, $141,558; betterments and repairs, $271,039. The net profit was $325,305, but dividends declared were not published. The mine is opened by tunnels, the lowest of which attained a depth of 1,700 feet. On No. 3 tunnel level, the ore shoot was said to be 285 feet long and 50 feet wide. In 1909, 1,217 feet of work was done. The Stanley Consolidated Mining and Milling Company made a shipment of antimony ore containing gold and silver. The Tamarack and Chesapeake mines remained unproductive.

Placer Center district.—With the exception of some concentrate made from creek tailings, the production of the district was that of the Success Mining Company. During the last four months of the year the mine and mill were operated; sulphide zinc concentrate and a slight tonnage of lead concentrate was marketed. In 1907, the mine was shipping at the rate of 1,000 tons per month. The state report gives the output as 1,600,000 pounds of zinc and 300,000 pounds of lead in 1909—probably an estimate.

St. Joe district.—Near the headwaters of St. Joe River the Golden Gate placer group was operated and a slight amount of fine gold was sold. The Monitor mine, from which rich copper ore was shipped in 1907, had considerable work done. The completion of the Chicago, Milwaukee, and Puget Sound Railroad, which was tunneling the range for 9,000 feet from near Taft, Mont., to the Idaho side, will eventually assist in developing this region along the St. Joe River.

Summit district.—The Summit district includes property near Murray and a great part of what is known as the North side of the Cœur d'Alene region. Production from 4 deep mines and 1 placer was 3,489 tons of crude ore which yielded gold valued at $525, 4,304 ounces of silver, and 1,427,925 pounds of lead, a total value of $64,164. This is more lead than the region ever produced, and the future will doubtless bring further increase. During the year, the Idaho Northern Railroad was completed to the terminal, 6 miles east of Murray, where the principal shipping mines of the district are located. Considerable development was done in many properties, and lead ore or concentrate was shipped from the Bear Top, Monarch, and Black Horse mines. The largest shipper was the Bear Top mine, the mill of which was overhauled and operated in July. From the Monarch mine, which has similar ore, several shipments were made and for a time a 75-ton concentration plant was run. One shipment of ore worth $65 per ton in lead and silver was made from the Black Horse mine.

Yreka district.—The output of this district at Wardner was 555,383 tons of ore, which yielded $23,203 in gold, 2,016,562 ounces of silver, 486,705 pounds of copper, 99,692,512 pounds of lead, in all valued at $5,421,865. This is the largest production from any single district in the State and a considerable increase over the production of 1908. The Bunker Hill and Sullivan M. and C. Company, operating the largest lead mine of the region, decreased its lead output by about 9 per cent during the construction of a new and modern 500-ton concentration plant. This mill, in conjunction with the old plant, will produce about 1,400 tons of concentrate per day. According to the report to the county assessor, 340,480 tons of ore were extracted of a gross value of $2,961,332. Costs were as follows: Extraction,

$852,608; transportation, reduction, and sale, $1,228,288; and betterments and repairs, $304,948. The net profits were $575,547 and dividends amounting to $615,000 were declared. There are 197 contiguous claims in the group, and 4,946 feet of work was done in 1909. The company also owns a 1,000-ton concentration plant, in which the tailings from the regular mills are re-treated. The Caledonia mine, adjoining the Federal property at Wardner, became a shipper of ore rich in silver and lead and containing some gold and copper. In the course of development in the latter part of the year shipments were made at the rate of six to ten cars per month. The Wardner mines of the Federal Mining and Smelting Company increased their lead output to the extent of about 30 per cent over that of 1908. The mine and 500-ton mill were operated the entire year. According to the assessor's figures, 186,020 tons were extracted with a gross value of $1,672,072, and costs were: Extraction, $743,343; transportation, reduction, and sale, $576,281; construction and repairs, $1,768. The net profit was $350,678. Production was close to that of the Mace mines. In 1909, 6,790 feet of work was accomplished.

The Stewart mine, from which lead ore was shipped from 1904 to 1907, was unproductive.

TWIN FALLS COUNTY.

Snake River district.—The Klondyke and small placers near Twin Falls produced placer gold worth $2,696.

WASHINGTON COUNTY.

Seven Devils district.—The only producers of the county were the Peacock and the Arkansas mines, from which copper ore valued at $6,034 was shipped. The former was practically idle during the year, but operators of the latter continued development and extracted a large quantity of copper ore.

MONTANA.

By V. C. Heikes.

PRODUCTION.

In 1909 the production of gold, silver, copper, lead, and zinc in Montana was valued at $51,429,694, and was produced from 449 deep mines and 170 placers. About 79 per cent of the total value was that of the copper output, which was considerably in excess over that of any previous year, even passing the extraordinary totals of 1905, and placing the State in the lead, which was held by Arizona in 1908. With the increase in copper, silver, too, regained its rank; and the gold and zinc output improved over the production made in 1908, but lead output was a third less in quantity than in 1908. The silver production was mainly from copper ores mined at Butte. The total production of crude ore aggregated 5,421,185 tons, of which 635,210 tons were smelted, valued at $10,494,808, or an average value of $16.52 per ton. At concentration mills 4,434,936 tons of ore were treated, yielding 1,311,361 tons of concentrate, valued at

$37,721,403, an average value of $28.76 per ton. Milling plants using amalgamation and cyanide processes treated 315,533 tons, valued at $1,586,765, or $5.03 per ton in gold and silver. The metallic content of old slag and flue dust, aggregating 29,335 tons, and of copper precipitates from mine waters and tailings are included in the totals of crude ore smelted. The statement of production for 1908 and 1909, showing increase and decrease and valued at each year's commercial prices, is as follows:

Mine production of gold, silver, and associated metals in Montana in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold..........fine ounces..	147,913.33	$3,057,640	183,414.30	$3,791,510	+ 35,500.96	+ $733,870
Silver..........do....	10,356,199	5,488,785	12,378,714	6,436,931	+ 2,022,515	+ 948,146
Copper..........pounds..	251,667,795	33,220,149	312,058,011	40,567,541	+60,390,216	+7,347,392
Lead..........do....	4,596,570	193,056	2,983,430	128,287	− 1,613,140	− 64,769
Zinc..........do....	1,640,000	77,080	9,359,724	505,425	+ 7,719,724	+ 428,345
Total..........	....	42,036,710	....	51,429,694	....	+9,392,984

Montana's production of ore and its content for six years is as follows:

Tons of ore sold or treated in Montana in 1904–1909, and total content of gold, silver, and associated metals.

Year.	Tonnage.	Gold.	Silver.	Copper.	Lead.	Zinc.	Total value.
	Short tons.	*Fine ounces.*	*Fine ounces.*	*Pounds.*	*Pounds.*	*Pounds.*	
1904..........	4,643,092	206,419.45	12,817,285	290,681,572	2,299,291	....	$48,974,381
1905..........	5,020,137	231,913.75	13,231,300	304,723,526	6,264,998	1,560,000	60,709,155
1906..........	5,497,971	216,188.56	11,980,705	290,700,975	4,462,979	6,579,000	69,257,083
1907..........	4,148,496	158,970.51	9,317,605	220,108,792	3,748,304	243,100	53,670,592
1908..........	4,266,022	147,913.33	10,356,199	251,667,795	4,596,570	1,640,000	42,036,710
1909..........	5,421,185	183,414.30	12,378,714	312,058,011	2,983,430	9,359,724	51,429,694

The five smelters at Anaconda, Butte, Great Falls, and East Helena operated at full capacity, with but few interruptions. Operators of the larger mines of Butte have made improvements in equipments with the object of handling a greater quantity of copper ore at a lower cost per ton. Several of the companies which have been developing property for the last few years began shipments of copper ore in 1909, but the increased yield over the usual rate of production is due more directly to some of the older producers. The bulk of the copper ore was smelted at Montana plants. Zinc concentrate was shipped to Colorado, Oklahoma, and Kansas plants. Nearly all of the lead ores were treated by the smelter at East Helena and some were shipped to the Salt Lake City and Tacoma smelters. Gold bullion and gold precipitates from cyanide mills were shipped to refineries in Montana, Colorado, and Nebraska.

ORE PRODUCTION IN 1909.

Ore mined in 1909 aggregated 5,421,185 tons. The production increased 1,155,163 tons in quantity but decreased in total value per ton from $9.72 in 1908 to $9.39 in 1909, and the gold and silver value in this ore decreased from $1.87 to $1.79. Production of siliceous ore increased from 390,442 tons in 1908 to 416,329 tons in 1909. The greatest quantity of this kind of ore was produced in Fergus County, whose output differed very little from the production of 1908. Output of copper ore increased from 3,828,876 tons in 1908 to 4,965,001 tons in 1909. Silver Bow County had the greatest output of copper ore, which represented nearly the total output of the State. Lead ore decreased in quantity from 18,274 tons in 1908 to 4,678 tons in 1909; zinc ore increased from 28,133 tons in 1908 to 34,463 tons in 1909; copper-lead ore increased from 297 tons in 1908 to 610 tons in 1909; and lead-zinc ore, 104 tons in quantity, was the production from 1 mine in 1909. The average yield per ton of gold and silver in siliceous ores in 1909 was $7.87, as against $6.85 in 1908; in copper ore, $1.23, as against $1.32 in 1908; in lead ore, $21.61, as against $11.34 in 1908; in zinc ore, $4.28, as against $2.91 in 1908; in copper-lead ore, $42.92, as against $47.84 in 1908.

Subdivision of tonnage of ore sold or treated in Montana in 1909, by counties, in short tons.

County.	Siliceous ore.	Copper ore.	Lead ore.	Zinc ore.	Copper-lead ore.	Lead-zinc ore.	Total.
Beaverhead	128	334	274		521		1,257
Broadwater	15,515	294	231				16,040
Cascade	1,681		275				1,956
Chouteau and Lincoln	78,645		16				78,661
Deer Lodge	6,982		72				7.054
Fergus	196,941		10				196,951
Granite	11,813	225	289		29		12,356
Jefferson	54,078	2,499	1,010				57,587
Lewis and Clark	22,260	1	1,424		31		23,716
Madison	21,111	10	501				21.622
Meagher, Park, and Ravalli	2,520	72					2,592
Missoula and Sanders		29	29		29	104	191
Powell	558	350	232				1,140
Silver Bow	4,097	4,961,187	315	34,463			5,000,062
Total	416,329	4,965,001	4,678	34,463	610	104	5,421,185
Value per ton in gold and silver	$7.86	$1.23	$21.61	$4.28	$42.92	$4.62	$1.79

GOLD.

Gold production from quartz milling carried on in 15 counties in 1909 showed an increased yield over the output of 1908, principally from properties in the Kendall district, in Fergus County, and the Little Rockies district, in Chouteau County. The output of both placer and quartz gold, as reported by the producers, aggregated 183,414.30 fine ounces, valued at $3,791,510. Compared with the figures of 1908, this indicated an increase of 35,500.96 ounces in quantity and of $733,870 in value. There was very little change in the total placer production. Powell County produced about one-half as much in 1909 as in 1908, and decreases were noted in Lewis and Clark, Deer Lodge, and Lincoln counties. The placer output increased in Jefferson, Broadwater, Beaverhead, and Silver Bow, and also slightly in Madison County. These increase made up for the decreases in the other counties. The gold yield from placer mining, nearly three-fourths of which came from Madison County, in 1909 amounted to $543,372, as against a yield in 1908 of $549,995. At amalgamation and cyanide mills 74,277.80 ounces were produced, averaging $4.86 per ton of ore treated. Fergus County, holding the lead in 1908, continued in 1909 with the greatest yield from gold and silver ores. Ores treated at concentration mills producing concentrates contained 34,185.03 ounces of gold, averaging 54 cents per ton. In 1908 the average value per ton was 56 cents. The crude ore of shipping grade to smelters contained 48,665.86 ounces and averaged $1.58 per ton, as against an average of 91 cents per ton in 1908.

Source of gold production in Montana, by kinds of ore, in 1909, by counties, in fine ounces.

County.	Placers.	Deep mines.					Total.
		Siliceous ore.	Copper ore.	Lead ore.	Zinc ore.	Copper-lead ore.	
Beaverhead	327.89	171.09	17.78	18.36		49.35	584.47
Broadwater	267.85	12,009.68	9.56	80.65			12,367.74
Cascade	24.49	63.76		5.71			93.96
Chouteau and Lincoln	4.25	33,008.73		1.98			33,014.96
Deer Lodge	72.26	9,427.28		2.13			9,501.67
Fergus		35,121.17		.72			35,121.89
Granite	679.28	3,079.31	1.57	19.42		.59	3,780.17
Jefferson	287.30	4,457.71	399.73	197.80			5,342.54
Lewis and Clark	821.74	5,420.57		327.76		11.29	6,581.36
Madison	20,700.97	11,964.65	11.64	681.75			33,359.01
Meagher, Park, and Ravalli	227.52	546.79	.09				774.40
Missoula and Sanders	1,223.06		.14	33.63		.88	1,257.71
Powell	1,365.19	502.60	72.10	251.10			2,190.99
Silver Bow	283.82	930.25	37,489.11	45.32	694.93		39,443.43
Total	26,285.62	116,703.59	38,001.72	1,666.33	694.93	62.11	183,414.30

SILVER.

In 1909 the output of silver amounted to 12,378,714 fine ounces in quantity, valued at $6,436,931. Compared with the figures of 1908, this indicated an increase of 2,022,515 ounces in quantity and of $948,146 in value. With the increase in tonnage of copper ores, the silver yield correspondingly increased, and from that source 10,281,046 ounces were produced in 1909. Silver Bow County was credited with over nine-tenths of the total silver produced. Siliceous ores yielded 1,660,061 ounces, against a production of 1,715,386 ounces in 1908. Silver production from lead ores aggregated 128,179 ounces, or less than half the quantity produced from the same source in 1908. Silver from zinc ores increased from 35,861 ounces in 1908 to 256,456 ounces in 1909, and from copper-lead ores the increase was from 24,743 ounces in 1908 to 47,887 ounces in 1909. The crude ore treated at smelters yielded 3,837,785 ounces, averaging 6.04 ounces per ton. In 1908 the average was 5.55 ounces per ton. The concentrates produced at milling plants contained 8,438,103 ounces, or an average of 6.43 ounces per ton. This was about the same average as in 1908. Cyanide and amalgamation mills treated ore yielding 98,667 ounces, or an average of 0.312 of an ounce per ton, which was nearly the same average as in 1908. Silver Bow County led in the production of silver and Jefferson County was second.

Source of silver production in Montana, by kinds of ore, in 1909, by counties, in fine ounces.

County.	Placers.	Deep mines.						Total.
		Siliceous ore.	Copper ore.	Lead ore.	Zinc ore.	Copper-lead ore.	Lead-zinc ore.	
Beaverhead	55	3,069	16,518	5,765		45,651		71,058
Broadwater	31	3,941	271	7,973				12,216
Cascade		75,831		25,286				101,117
Chouteau and Lincoln		45,888		110				45,998
Deer Lodge	8	3,638		1,156				4,802
Fergus		5,240		251				5,491
Granite	193	325,299	3,417	26,091		1,485		356,485
Jefferson	51	950,329	48,553	32,213				1,031,146
Lewis and Clark	185	17,471		15,732		363		33,751
Madison	3,328	83,495	97	4,938				91,858
Meagher, Park, and Ravalli	20	202	21					243
Missoula and Sanders	49		14	452		388	926	1,829
Powell	171	6,437	3,274	3,510				13,392
Silver Bow	68	139,221	10,208,881	4,702	256,456			10,609,328
Total	4,159	1,660,061	10,281,046	128,179	256,456	47,887	926	12,378,714

COPPER.

The yield of copper in 1909 amounted to 312,058,011 pounds, valued at $40,567,541. As compared with figures of 1908 this showed an increase of 60,390,216 pounds, which was credited almost entirely to Silver Bow County and to small increases in Powell, Deer Lodge, Madison, and Fergus counties, all other counties having decreases reported against them. Crude or first-class ore shipped to smelters in 1909 yielded 56,755,683 pounds of copper, or an average of 89.35 pounds per ton, equivalent to 4.47 per cent. Included in this crude ore to smelters was the metallic content of 29,335 tons of old slag and flue dust, containing 1,849,736 pounds of copper. Mine waters and solutions from old tailings passing over scrap iron as a precipitant produced copper precipitates, which contained 6,467,068 pounds of copper. Concentrates contained 246,985,524 pounds of copper, an average of 188.34 pounds per ton, equivalent to 9.42 per cent. The average content of the copper ores classified as such in 1909 was 62.71 pounds per ton. Siliceous or dry ores, which included iron sulphides and oxidized ores, carried 0.43 pound per ton; copper-lead ore, 97.15 pounds per ton; and zinc ore, 12.99 pounds per ton.

LEAD.

The production of lead in 1909 amounted to 2,983,430 pounds, valued at $128,287, as against 4,596,570 pounds, valued at $193,056, in 1908. Mines in 13 counties supplied the lead. The lowest production was from Lincoln County, with 2,619 pounds, and the highest output, 1,568,696 pounds, came from Jefferson County. The average content of the lead ores classified as such in 1909 was 256.81 pounds per ton. Siliceous ores carried 3.36 pounds per ton; copper-lead ore, 476.75 pounds per ton; and lead-zinc ore, 160 pounds per ton. Crude ore to smelters contained 2,596,225 pounds, an average of 4.09 pounds per ton. This average is for the total ore smelted and includes the large tonnage of copper ore producing no lead. Concentrates contained 387,205 pounds of lead, produced from ore treated in mills in Jefferson, Beaverhead, Broadwater, Silver Bow, Lewis and Clark, and Cascade counties, named in order of importance.

ZINC.

The mine production of zinc in 1909, calculated according to output of spelter, amounted to 9,359,724 pounds, valued at $505,425, an increase of 7,719,724 pounds in quantity and of $428,345 in value. In 1907 the spelter output was 243,100 pounds. More attention than ever before was given to zinc mining in the Butte district, and preparation was made for production in other parts of the State. The largest output of zinc was in 1909 shipped from Butte in the form of concentrate, treated in a new mill, an addition to the Butte Reduction Works, which handles nearly 300 tons of zinc ore daily. About 2½ tons of ore made a ton of zinc concentrate, assaying 40 per cent of zinc, 4 per cent of copper, 25 ounces of silver, and $1 in gold per ton. The zinc belt of Butte lies north of the city and extends east and west for a distance of 2 miles, having a width of several hundred feet. It contains copper ore bodies at different points. Many of the Butte properties have, in the past, been rendered practically worthless by the predominance of the zinc and the inability to mine the copper ore at a profit. The Elm Orlu mine is a new producer of zinc, yielding an ore which is making a marketable zinc concentrate. It is expected the Black Rock mine will also be regular in production of zinc concentrate when arrangements are completed for a mill. Shipments of concentrate were made to Colorado and to works in Oklahoma and Kansas. At Superior, in Missoula County, the Iron Mountain Tunnel Company is reported to have 6 feet of sulphide zinc ore, and two shipments of ore made in 1909 averaged well in the metal. The zinc smelters treating zinc ores and concentrates after distillation of the zinc sell the residue to lead and copper smelters, for whom it is an excellent material, being practically free from sulphur and zinc.

MINING INDUSTRY IN MONTANA IN 1909.

An unusually large amount of development work was done in the mines, especially those at Butte, where new ore bodies were opened and many changes were made with a view to the economical handling of the ores. Several important mines have been added to the Butte list of copper producers. Ore production in December was retarded by the switchmen's strike, which shut off operators of a number of mines in Silver Bow and Jefferson counties from shipping ore on the Northern Pacific and Great Northern railways. Shortly after the close of 1909 the consolidation of the great copper companies at Butte was arranged for to include the Boston-Montana, Red Metal, Washoe, Butte and Boston, Trenton, Parrot, and the Alice Gold and Silver Mining companies. Hereafter the mines of these companies will be operated by the Anaconda Copper Company. Another consolidation was effected by the East Butte Copper Company absorbing the Pittsmont smelter and mines of the Pittsburg and Montana Company. Outside of Silver Bow County, in which Butte is situated, much development work was also done in other camps, and shipments of ore and bullion were made in their usual quantities.

The old mines at Marysville, in Lewis and Clark County, were operated by lessees, and tailings from the mills which worked the ores of the Penobscot and Gloster mines produced cyanide precipitates and bullion. In the old silver mines in Granite County some leasing was done, and lately there has been renewed activity by several of the companies in that county. In Deer Lodge County interest was aroused over the success of lessees in opening promising bodies of siliceous gold ore in the mines near Georgetown. In Chouteau County the Ruby mine was operated the entire year and the August mine began producing siliceous gold-silver ore in March. Both properties are in the Little Rockies district and each has a mill in which the cyanide process is used. Auriferous pyrite ore was shipped in greater quantity than ever before from the Keating mine, near Radersburg, in Broadwater County. The Ohio and Black Friday properties in the same region produced similar ore, which was shipped to smelters. Ore from the three mines, carrying about $16 per ton in gold, about 54 per cent of iron, 35 per cent of silica, and traces of silver and copper, is in demand by the smelters for flux. Gold dredging at Ruby, in Madison County, was successfully carried on during 1909. Three dredges, electrically equipped, were in operation. On Cedar Creek, in Missoula County, operations were begun with a bucket dredge in November.

The gold dredge at Rocker, near Butte, was not operated after a short run the first part of 1909.

A number of changes were made at the Washoe and Great Falls smelters. The large stack of the latter was put in use during the summer. The smelter and the concentrator were being enlarged, and when completed will have a capacity of 5,000 tons of ore per day. The capacity in 1909 was about 3,500 tons. At the Washoe plant, a new system of dams and reservoirs was under construction near Warm Springs for the purpose of settling out the solids and clarifying the water from the concentrator before discharging into the Deer Lodge River. These improvements will likely remove the remaining cause of complaints by farmers in the Deer Lodge Valley, who allege damage from the tailings water coming from the reduction works. One of the largest electric power plants in the world is being built at the falls of the Missouri River, at Great Falls, Mont., and when completed it will furnish power to a central plant in Butte, from which it will be distributed to all the mines.

Railroad building of importance to mining districts was continued during the year by the Chicago, Milwaukee and Puget Sound Railway. In September the road was open for traffic, affecting principally properties in Missoula County. Grading was completed by the Pittsburg and Gilmore line from Armstead, Mont., to Gilmore, Idaho. The line will help to develop mining properties in Beaverhead County. The concentrator at Basin, owned by the La France Copper Company, was put in operating condition the latter part of 1909 to receive the low-grade silver-zinc ores, of which 175 tons per day were shipped for concentration from the Butte-Superior mines, at Butte.

Mine production of gold, silver, copper, lead, and zinc in Montana in 1909, by counties.

County.	Gold.				Silver.	
	Placer.		Deep mines.			
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Fine ounces.		*Fine ounces.*		*Fine ounces.*	
Beaverhead	327.89	$6,778	256.58	$5,304	71,058	$36,950
Broadwater	267.85	5,537	12,099.89	250,127	12,216	6,352
Cascade	24.49	506	69.47	1,436	101,117	52,581
Chouteau and Lincoln	4.25	88	33,010.71	682,392	45,998	23,919
Deer Lodge	72.26	1,494	9,429.41	194,923	4,802	2,497
Fergus			35,121.89	726,034	5,491	2,855
Granite	679.28	14,042	3,100.89	64,101	356,485	185,372
Jefferson	287.30	5,939	5,055.24	104,501	1,031,146	536,196
Lewis and Clark	821.74	16,987	5,759.62	119,062	33,751	17,551
Madison	20,700.97	427,927	12,658.04	261,665	91.858	47,766
Meagher, Park, and Ravalli	227.52	4,703	546.87	11,305	243	127
Missoula and Sanders	1,223.06	25,283	34.65	716	1,829	951
Powell	1,365.19	28,221	825.81	17,071	13,392	6,964
Silver Bow	283.82	5,867	39,159.61	809,501	10,609,328	5,516,850
Total	26,285.62	543,372	157,128.68	3,248,138	12,378,714	6,436,931

County.	Copper.		Lead.		Zinc.		Total value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
	Pounds.		*Pounds.*		*Pounds.*		
Beaverhead	95,309	$12,390	387,851	$16,678			$78,100
Broadwater	180,693	23,490	50,941	2,190			287,696
Cascade	540	70	109,589	4,712			59,305
Chouteau and Lincoln			2,619	113			706,512
Deer Lodge	10,040	1,305	27,104	1,165			201,384
Fergus	204	26	11,210	482			729,397
Granite	62,251	8,093	76,189	3,276			274,884
Jefferson	241,655	31,415	1,568,696	67,454			745,505
Lewis and Clark	5,798	754	293,285	12,611			166,965
Madison	22,491	2,924	191,045	8,215			748,497
Meagher, Park, and Ravalli	30,805	4,005					20,140
Missoula and Sanders	2,784	362	36,686	1,578	60,570	$3,271	32,161
Powell	81,791	10,633	29,159	1,254			64,143
Silver Bow	311,323,650	40,472,074	199,056	8,559	9,299,154	502,154	47,315,005
Total	312,058,011	40,567,541	2,983,430	128,287	9,359,724	505,425	$51,429,694

Tonnage of ore sold or treated, number of mines producing, and average value per ton of ores in Montana in 1908 and 1909, by counties.

County.	Ore sold or treated (short tons).		Number of deep mines producing.		Average value per ton.[a]		Average value per ton in gold and silver.[a]	
	1909.	Increase (+) or decrease (−).	1908.	1909.	1908.	1909.	1908.	1909.
Beaverhead	1,257	+ 303	15	19	$47.73	$56.72	$26.21	$33.59
Broadwater	16,040	+ 1,312	27	32	19.10	17.59	10.81	15.99
Cascade	1,956	+ 853	15	9	57.05	30.06	49.43	27.66
Chouteau and Lincoln	78,661	+ 18,843	3	7	4.56	8.98	4.56	8.98
Deer Lodge	7,054	− 30	8	13	9.61	28.34	9.60	27.99
Fergus	196,951	− 746	8	8	3.88	3.70	3.88	3.70
Granite	12,356	− 6,447	23	31	17.79	21.10	16.95	20.18
Jefferson	57,587	− 4,100	52	56	13.14	12.84	11.22	11.12
Lewis and Clark	23,716	− 9,021	44	64	9.52	6.32	7.84	5.76
Madison	21,622	+ 9,950	90	105	17.16	14.75	16.23	14.23
Meagher, Park, and Ravalli	2,592	+ 2,072	6	5	22.30	5.95	12.33	4.41
Missoula and Sanders	191	− 122	4	5	4.21	35.88	1.72	8.60
Powell	1,140	+ 292	12	23	36.77	31.43	23.25	21.00
Silver Bow	5,000,062	+1,142,004	102	71	9.92	9.46	1.34	1.26
Total	5,421,185	+1,155,163	409	448	9.72	9.39	1.87	1.79

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[a] Value per ton, placer product excluded.

Tonnage of ores to gold and silver mills and concentrating mills, with gold and silver contained in bullion produced in Montana in 1909, by counties.

County.	Ore to gold and silver mills.			Ore to concentrating mills.
	Quantity.	Gold in bullion.	Silver in bullion.	
	Short tons.	*Fine ounces.*	*Fine ounces.*	*Short tons.*
Beaverhead	1	0.40	....	150
Broadwater	1,921	1,011.25	194	160
Cascade	600	9.11	72	64
Chouteau and Lincoln	78,544	31,048.90	42,468	....
Deer Lodge	1,088	851.40	306	....
Fergus	196,737	33,868.36	4,317	....
Granite	818	164.33	6,344	10
Jefferson	61	36.75	4,859	32,800
Lewis and Clark	18,273	4,630.49	13,717	....
Madison	17,191	2,503.64	26,358	124
Meagher, Park, and Ravalli	20	33.86	6	....
Missoula and Sanders	....	....	....	....
Powell	264	111.50	24	....
Silver Bow	15	7.81	2	4,401,628
Total	315,533	74,277.80	98,667	4,434,936

Mine production of gold, silver, and associated metals from Montana concentrates in 1909, by counties.

County.	Concentrates produced.						Total value.
	Quantity.	Gold.	Silver.	Copper.	Lead.	Zinc.	
	Short tons.	*Fine ounces.*	*Fine ounces.*	*Pounds.*	*Pounds.*	*Pounds.*	
Beaverhead	42	0.49	383	1,216	26.784	....	$1,519
Broadwater	43	109.39	2.127	1,421	17,581	....	4,308
Cascade	16	12.92	1,558	....	105	....	1,081
Chouteau and Lincoln	....	....	....	....	....	....	....
Deer Lodge	18	40.29	31	52	....	....	856
Fergus	....	....	....	....	....	....	....
Granite	14	5.34	1,572	387	....	....	978
Jefferson	1,992	294.43	200,271	13,346	338,298	....	126,509
Lewis and Clark	52	47.93	59	140	365	....	1,056
Madison	724	2,533.92	23,995	11,547	....	....	66,359
Meagher, Park, and Ravalli	258	512.92	196	....	....	....	10.705
Missoula and Sanders	....	....	....	....	....	....	....
Powell	....	....	....	....	....	....	....
Silver Bow	1,308,202	30,627.40	8,207,911	246,957,415	4.072	9,299,154	37,508,032
Total	1,311,361	34,185.03	8.438,103	246,985,524	387,205	9,299,154	37,721,403

Mine production of gold, silver, copper, lead, and zinc from Montana crude ore shipped to smelters in 1909, by counties.

County.	Crude ore to smelter.						Total value.
	Crude ore.	Gold.	Silver.	Copper.	Lead.	Zinc.	
	Short tons.	*Fine ounces.*	*Fine ounces.*	*Pounds.*	*Pounds.*	*Pounds.*	
Beaverhead	1,106	255.69	70,620	94,093	361,067	....	$69,765
Broadwater	13,959	10,979.25	9,864	179,272	33,360	....	256,829
Cascade	1,292	47.44	99,487	540	109,484	....	57,492
Chouteau and Lincoln	117	1,961.81	3,530	....	2,619	....	42,502
Deer Lodge	5,915	8,537.72	4,457	9,988	27,104	....	181,272
Fergus	214	1,253.53	1,174	204	11,210	....	27,032
Granite	11.528	2,931.22	348,376	61,864	76,189	....	253,067
Jefferson	24,514	4,724.06	825,965	228,309	1,230,398	....	609,744
Lewis and Clark	2.035	1,081.20	19,790	5,658	292.920	....	45,973
Madison	4,307	7,620.49	38,177	10,944	191,045	....	187,019
Meagher, Park, and Ravalli	72	.09	21	30,805	....	....	4,018
Missoula and Sanders	191	34.66	1,780	2,784	36,686	60,570	6,854
Powell	876	714.31	13,197	81,791	29,159	....	33,515
Silver Bow	569,084	8,524.40	2,401,347	56,049,431	194,984	....	8,719,726
Total	635,210	48,665.86	3,837,785	56,755,683	2,596,225	60,570	10,494,808

Number of producing mines, classified by chief products, in Montana in 1909, by counties.

County.	Placer mines.			Deep mines.											Total mines producing.
	Hydraulic.	Dredge.	Drift.	Gold.	Silver.	Copper.	Gold-silver.	Gold-copper.	Gold-silver-copper.	Gold-silver-copper-lead.	Gold-silver-lead.	Silver-lead.	Silver-copper.	Silver-lead-zinc.	
Beaverhead	5								5	9	4		1		24
Broadwater	11		1	2			13		8	4	4		1		44
Cascade	1						1			2	4	2			10
Chouteau and Lincoln	1						6				1				8
Deer Lodge	1			1			8		3	1					14
Fergus							5		1	2					8
Granite	12		1	1			11		13	3	2		1		44
Jefferson	19			3			9	1	11	15	12	5			75
Lewis and Clark	34		3	4	1	1	29		4	[a]12	12	1			101
Madison	15	1		1			47		40	6	11				121
Meagher, Park, and Ravalli	7						2		2				1		12
Missoula and Sanders	17	1	1						1	1	1	1		1	24
Powell	30			1	1		5		9	2	6				54
Silverbow	8	1		1			19		34	[b]8	3	1	5		80
Total	161	3	6	14	2	1	155	1	131	65	60	10	9	1	619

[a] Two reported no gold.

[b] Two reported zinc.

PRODUCTION BY COUNTIES.

BEAVERHEAD COUNTY.

Mine production of gold, silver, and associated metals in Beaverhead County, Mont., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold.....fine ounces	328.47	$6,790	584.47	$12,082	+ 256.00	+ $5,292
Silver.....do	38,954	20,646	71,058	36,950	+ 32,104	+ 16,304
Copper.....pounds	129,879	17,144	95,309	12,390	− 34,570	− 4,754
Lead.....do	80,610	3,386	387,851	16,678	+ 307,241	+ 13,292
Total		47,966		78,100		+ 30,134

In 1909 there were 19 deep mine operators reporting, 4 more than in 1908. The output of ore was 1,257 tons, an increase of 303 tons over the output of 1908. The total average value per ton increased from $47.73 in 1908 to $56.72 in 1909, and the average gold and silver value of this ore, which was $26.21 in 1908, was $33.59 in 1909. The bulk of the ore, aggregating 1,106 tons, was shipped directly to smelters and yielded 255.69 ounces of gold, 70,620 ounces of silver, 94,093 pounds of copper, and 361,067 pounds of lead, valued in all at $69,765, an average value of $63.08 per ton. In addition to the ore shipped to smelters, 150 tons were treated at a concentration mill and 1 ton was treated as a test at an amalgamation mill. The output of the county in 1909 was classified and divided into 521 tons of copper-lead ore, 334 tons of copper ore, 274 tons of lead ore, and 128 tons of siliceous ore. The placer production of gold and silver made by 5 operators in 1909 aggregated $6,807, as against $2,430 in 1908.

Argenta district.—Three deep-mine operators reported the production of 218 tons of ore to smelters, which yielded $143 in gold, 2,266 ounces of silver, 1,919 pounds of copper, and 75,061 pounds of lead, in all valued at $4,799, an average value of $22.01 per ton. Sixty-eight tons of the output were of shipping grade and 150 tons were treated at a concentrating mill, producing concentrate which contained one-third of the total output of lead. The largest production was made from the Ferdinand property, which is equipped with a 5-stamp mill. The ore mined was of shipping grade. The Gladstone mine, which is opened by a vertical shaft 300 feet deep, was the next largest producer.

Bannock district.—One deep-mine and 4 placer operators reported production. Development of the West Adams and Golden Leaf claims of the Bannock Consolidated Company yielded, in the hands of lessees, an important tonnage of lead ore, containing gold and silver and a little copper. The most valuable part of the district's production in 1909 was the gold output of the placers, which, with the ore shipped from the district, had a total value of $10,379.

Beaverhead district.—Work was begun on the 2,800-foot tunnel, which is to open the Dark Horse property of the Calumet-Montana Mining Company 800 feet below the apex of the mountain and allow transportation of its ore from the Idaho side of the line by the Gilmore and Pittsburg Railway. One test shipment of copper ore was made in 1909. The Monument property, on Bloody Dick Creek, was closed and awaits the opening of the new railroad, which is nearly completed from Armstead, Mont.

Big Hole district.—The Tacoma mine produced a trial lot of lead ore, which, with the output of one placer producer, comprised the total production of the district, with an aggregate value of $248.

Blue Wing district.—The Kent group and the New Departure mine have been under development for the last two years. The principal metals contained in the ore produced in 1909 were lead and silver, with some copper. The total shipments from the district in 1909 aggregated 105 tons, having a total value of $11,342.

Bryant district.—Five operators of deep mines producing in 1909 reported an output aggregating 574 tons of shipping ore. Nearly all of the properties were worked by lessees. The ore yielded at smelters $1,309 in gold, 45,053 ounces of silver, 53,399 pounds of copper, 287,470 pounds of lead, with a total value of $44,039 and an average value of $76.72 per ton. In 1908 the output of shipping ore aggregated 181 tons. The deepest workings reported by those shipping in 1909 were in the Atlantis mine, which has an incline shaft 1,000 feet deep.

Elkhorn district.—Small shipments of ore, containing principally lead and silver, with some copper, were made to a smelter from the Ingersoll and Montana-Apex mines.

Utopia district.—The Greenstone and the Indian Queen properties were reported as producers in 1909, the ore shipped containing principally copper, with a little gold and silver. The latter property is opened by a shaft 530 feet deep.

Vipond district.—Two small lots of ore, containing principally silver, were shipped in 1909 from the Argyle mine and the Evans group.

BROADWATER COUNTY.

Mine production of gold, silver, and associated metals in Broadwater County, Mont., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold.................fine ounces..	7,247.64	$149,822	12,367.74	$255,664	+5,120.10	+$105,842
Silver.......................do....	25,502	13,516	12,216	6,352	− 13,286	− 7,164
Copper..................pounds..	833,803	110,062	180,693	23,490	− 653,110	− 86,572
Lead.......................do....	286;102	12,016	50,941	2,190	− 235,161	− 9,826
Total..........................	....	285,416	....	287,696	....	+ 2,280

Reports from 32 mine operators, an increase of 5 over those reporting in 1908, showed a corresponding increase in 1909 in the production of ore, which aggregated 16,040 tons. The total value of the ore per ton, however, decreased from $19.10 in 1908 to $17.59 in 1909, but the average value of the gold and silver contained in this ore increased from $10.81 in 1908 to $15.99 in 1909. The bulk of the ore was of shipping grade and aggregated 13,959 tons, which contained 10,979.25 ounces of gold, 9,864 ounces of silver, 179,272 pounds of copper, and 33,360 pounds of lead, with a total value of $256,829 and an average value of $18.40 per ton. The smelting ores shipped in 1908 aggregated 8,454 tons and averaged $27.41 per ton. Production of concentrating ores decreased from 6,155 tons in 1908 to 160 tons in 1909. Only a small tonnage of concentrates was shipped to the smelter. At milling plants using the amalgamation process 1,921 tons were treated, yielding bullion containing 1,011.25 ounces of gold and 194 ounces of silver. A few tons of concentrate, which contained only gold and silver, were recovered from the same ore. The product of 12 placer properties aggregated $5,553 in 1909, as against a production of $4,069 in 1908.

Backer district.—Three deep mines and 4 placers yielded an output valued at $40,334. The principal part of the ore mined was treated at amalgamation mills and yielded 843.52 ounces of gold and 175 ounces of silver; also 3 tons of concentrate, which contained 68.73 ounces of gold and 210 ounces of silver. The smelting ore shipped amounted to 268 tons, which contained a small quantity of silver and the bulk of the copper produced in the county. The principal deep mine producing shipping ore was the Eclipse-Argo. The Slim Jim mine was a producer of gold and silver bullion, which was extracted in a 1-stamp mill on the property.

Beaver Creek district.—The yield of ore and placer gold came from 10 deep mines and 2 placers. The output of the district consisted of $18,575 in gold, 8,721 ounces of silver, 3,017 pounds of copper, and 44,695 pounds of lead, having a total value of $25,425. All but $143 in gold and 1 ounce of silver, which was the placer output, was from 546 tons of ore. In 1908 the total ore output was 976 tons. Ore shipped to smelters aggregated 394 tons, which yielded the greater part of the lead and copper, and 152 tons were treated at a concentration mill. The principal metals contained in the ores are lead and silver, with a little copper. The larger part of the tonnage was classified as siliceous or dry ore. The principal producers were the East Pacific, Eclipse, Edna, Iron Age, Hard Cash, Triumph, and Winston Miner. A number of other properties produced small quantities of ore.

Cedar Plains district.—Ten operators of deep mine and 2 of placers reported a total production aggregating $209,365 in gold, 2,426 ounces of silver, and 21,601 pounds of copper, with a total value of $213,434. With the exception of $1,146 in gold from placers, this production was from 13,257 tons of crude ore, all of which, with the exception of 18 tons treated in an amalgamation mill, was shipped directly to smelters. The largest producer was the Keating mine, at Radersburg, which yielded nearly all of the gold, but very little of the silver. In June the workings of the mine had gained 350 feet in depth, opened by a vertical shaft. According to the published annual statement of the company, the ore is opened for more than 1,000 feet on the 350-foot level. Some of the shipments of auriferous iron pyrite from this property have shown as much as 0.75 per cent of copper, but the general average is estimated at 0.08 per cent of copper, and the silver is estimated at 0.096 of an ounce per ton. The gold value of 12,705.81 tons of ore shipped to the end of May, 1909, averaged $15.88 per ton. The ore occurs in a fissure in the diorite. Other important producers were the Black Friday, Ohio, and Blacker, Pinchbeck, and Combination properties.

Park district.—Eight quartz properties and 3 placers were reported as producers in 1909. The bulk of the ore mined was treated at an amalgamation mill, and bullion, with 2 tons of concentrate, were produced. Forty-two tons of crude ore were shipped to smelters. The total value of the district output was $7,790—$7,007 in gold, 552 ounces of silver, 1,750 pounds of copper, and 6,246 pounds of lead. The principal producing mine was the Diamond Hill. Other mines with smaller productions were the John L., Kinty County, and Mammoth.

CASCADE COUNTY.

Mine production of gold, silver, and associated metals in Cascade County, Mont., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold.....fine ounces..	226.78	$4,688	93.96	$1,942	−132.82	−$2,746
Silver.....do....	94,021	49,831	101,117	52,581	+ 7,096	+ 2,750
Copper.....pounds..	6,352	839	540	70	− 5,812	− 769
Lead.....do....	180,320	7,574	109,589	4,712	−70,731	− 2,862
Total.....	.....	62,932	.....	59,305	.....	− 3,627

Nine deep mine producers aggregated an output of 1,956 tons of ore. A placer production of 24.49 ounces of gold was reported, which probably should have been credited to one of the deep mines, as no placer mining has heretofore been reported in the county. The larger part of the ore output, or 1,292 tons, was shipped directly to the smelters; 600 tons were treated at a cyanide mill; and a few tons of concentrate produced at one of the mills were shipped to the smelter. The principal producer of ore was the Ripple mine, in which the development has consisted of driving a crosscut to tap the ore about 200 feet below the present workings. Operators of the Broken Hill mine shipped lead ore. The Queen of the Hills mine also produced in 1909. Lessees worked in the Lexington mine. The new cyanide plant on Snow Creek, erected to treat I. X. L. mine ore, was closed, it is said, on account of the excessive snow. The Johannesburg region continues to attract attention. A vein of gold-bearing quartz, varying in width from 6 to 20 feet, has been opened on the Johannesburg mine. The shaft is 315 feet deep. A heavy flow of water was encountered in the 300-foot level when crosscutting for the vein. The mine was equipped with pumping machinery in 1909.

CHOUTEAU COUNTY.

Little Rockies district.—The 100-ton cyanide mill of the August mine at Landusky was put in operation in March. The ore treated is said to average $27 in gold and silver, of which 75 per cent was saved. To the close of 1909 nearly $340,000 in ore and bullion was shipped to the smelters and the Government assay office. At Zortman the Ruby Gulch mine and reduction plant were steadily operated. About 5,000 tons of ore, averaging about $4 per ton, were treated monthly by the cyanide process. The gross value of the bullion shipped was given as $350,000.

DEER LODGE COUNTY.

Thirteen operators of deep mines in 1909 produced 7,054 tons of ore, 30 tons less than was mined by 8 operators in 1908. The total value of the ore increased per ton from $9.61 in 1908 to $28.34 in 1909, and the gold and silver average value increased from $9.60 in 1908 to $27.99 in 1909. The ore mined contained $194,923 in gold, 4,794 ounces of silver, 10,040 pounds of copper, and 27,104 pounds of lead, with a total value of $199,886. In 1908 the ore produced was valued at $70,567. The larger part of the tonnage in 1909, or 5,915 tons, was shipped directly to the smelters. The remainder produced 18 tons of concentrate, containing principally gold and silver. The placer gold production aggregated $1,498, as against an output valued at $2,463 in 1908.

Georgetown district.—This district is situated about 17 miles west of Anaconda. All of the ores produced are chiefly oxidized and yielded in 1909 principally gold and silver, with a small percentage of copper. Eleven operators reported the production of 6,390 tons, aggregating $188,086 in gold, 4,539 ounces of silver, 9,988 pounds of copper, and 27,104 pounds of lead, with a total value of $192,909, and an average value per ton of $30.19. In 1908 the value of 6,819 tons of ore, representing the output of the district, averaged $9.46 per ton. The bulk of the shipments was oxidized iron ore, containing lime, and was shipped directly to smelters and used as flux. The remainder of the ore produced was treated at a milling plant. The principal producers were the Southern Cross, Oro Fino, Gold Coin, Holdfast, and Cincinnati mines. Development work only has been done in the Southern Cross mine for several years and no ore taken out except as it was encountered in development, when it was shipped to the Washoe smelter. There are about 5 miles of drifts in the mine.

FERGUS COUNTY.

Mine production of gold, silver, and associated metals in Fergus County, Mont., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold.....fine ounces..	36,818.02	$761,096	35,121.89	$726,034	−1,696.13	−$35,062
Silver.....do....	10,773	5,710	5,491	2,855	− 5,282	− 2,855
Copper.....pounds..			204	26	+ 204	+ 26
Lead.....do....			11,210	482	+ 11,210	+ 482
Total.....		766,806		729,397		− 37,409

Eight operators of deep mines in 1909, the same number reporting in 1908, mined 196,951 tons of ore, which was 746 tons less than in 1908. The total average value of the ore was practically all for the gold and silver content, as the small quantities of copper and lead did not affect the average values. The total average value decreased from $3.88 in 1908 to $3.70 per ton in 1909. Nearly all of the ore was treated at mills using the cyanide process, except some of higher grade, aggregating 214 tons, which was shipped directly to the smelters and yielded $25,913 in gold, 1,174 ounces of silver, 204 pounds of copper, and 11,210 pounds of lead, with a total value of $27,032, and an average value per ton of $126.32.

North Moccasin district.—There was but little change in the output of the district over that made in 1908. In 1909 the value was $622,817, of which $620,846 was for gold and the remainder for 3,790 ounces of silver. The Barnes King, Kendall, and North Moccasin properties were the principal producers. The Barnes King property is opened by a vertical shaft to a depth of 400 feet, and the Kendall to 620 feet. The North Moccasin mine, which was closed in April, was opened by a shaft 600 feet deep.

Warm Springs district.—Five mine operators reported a production of 39,854 tons of ore, which contained $105,188 in gold, 1,701 ounces of silver, 204 pounds of copper, and 11,210 pounds of lead, with a total value of $106,580, and an average yield of $2.67 per ton. The properties producing were the Gold Reef, Cumberland, Spotted Horse, Maginnis, and Justice. The last-named property yielded an ore containing lead. The Cumberland cyanide mill was in operation almost continously during the year. Some shipping ore and large ore bodies of milling grade were developed in the Maginnis mine. On Cayuse Mountain large bodies of silver-gold ore were reported to have been opened in 1909.

GRANITE COUNTY.

Mine production of gold, silver, and associated metals in Granite County, Mont., in 1908 and 1909.

Metal.	1908.		1909.		Decrease.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold.....fine ounces..	4,500.85	$93,041	3,780.17	$78,143	720.68	$14,898
Silver.....do....	450,068	238,536	356,485	185,372	93,583	53,164
Copper.....pounds..	74,317	9,810	62.251	8,093	12,066	1,717
Lead.....do....	142,455	5 983	76 189	3.276	66,266	2,707
Total.....		347 370		274,884		72,486

There were 31 deep mine operators reporting in 1909, or 8 more than in 1908. The output of ore amounted to 12,356 tons, a decrease of 6,447 tons from the output of 1908. The total average value per ton increased from $17.79 in 1908 to $21.10 in 1909, and the gold and silver average value of this ore from $16.95 to $20.18 per ton. The largest proportion of the ore was shipped directly to smelters and aggregated 11,528 tons, which contained 2,931.22 ounces of gold, 348,376 ounces of silver, 61,864 pounds of copper, and 76,189 pounds of lead, with a total value of $253,067, an average value of $21.95 per ton. Bullion and concentrate were extracted from 818 tons of ore, which yielded 164.33 ounces of gold and 6,344 ounces of silver and 14 tons of concentrate, containing 5.34 ounces of gold, 1,572 ounces of silver, and 387 pounds of copper. The output of gold and silver from placer operations aggregated $14,142, against a production in 1908 of $12,859.

First Chance district.—The yield made by 16 operators, including the output from 4 placer properties, aggregated $39,520 in gold, 1,865 ounces of silver, and 2,324 pounds of copper. All of the ore, with the exception of 10 tons, which were treated at a concentration mill, was shipped to smelters. Of the total output of the district, $2,252 in gold and 13 ounces of silver were credited to the placers. The placer output in 1908 was $895 in gold and 11 ounces of silver. Many of the deep-mine properties were operated by lessees. The principal producers were the Nancy Hanks, First Chance, Shamrock, International, San Jose, Sierra, and Spokane mines.

Flint Creek district.—Reports were received from 12 deep mines and 4 placers in this district, which aggregated an output of $23,580 in gold, 352,279 ounces of silver, 57,387 pounds of copper, and 71,670 pounds of lead, having a total value of $217,308. Smelters received 10,830 tons of the total output and 13 tons of concentrate. The latter was the by-product of 547 tons of ore treated at an amalgamation mill, which yielded, beside the concentrate, bullion containing 32.09 ounces of gold and 6,317 ounces of silver. The Granite-Bi-Metallic was the largest producer of the district, supplying ore directly to the smelters. The Hope mine was operated until June by the company and after that by lessees. The property is equipped with a 10-stamp wet crushing amalgamation mill. Other producers were the Hobo group, principally worked by lessees, and the Headlight, Gem, Coyote, Mariola, and Red Lion mines.

South Boulder district.—The output of 10 mines, which includes 4 placers, aggregated $14,614 in gold, 2,338 ounces of silver, 2,540 pounds of copper, and 4,519 pounds of lead, having a total value of $16,354. The ore mined was 304 tons, of which 236 tons were treated at an amalgamation mill and yielded bullion containing 118.26 ounces of gold and 25 ounces of silver, and 68 tons were shipped directly to the smelters, and contained 88.25 ounces of gold, 2,146 ounces of silver, and all of the copper and lead mentioned in the total. The output of the placers aggregated $11,246 in gold and 167 ounces of silver.

JEFFERSON COUNTY.

Mine production of gold, silver, and associated metals in Jefferson County, Mont., in 1908 and 1909.

Metal.	1908.		1909.		Decrease.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold..................fine ounces..	6,726.68	$139,053	5,342.54	$110,440	1,384.14	$28,613
Silver........................do....	1,047,157	554,993	1,031,146	536,196	16,011	18,797
Copper...................pounds..	338,331	44,660	241,655	31,415	96,676	13,245
Lead........................do....	1,747,463	73,393	1,568,696	67,454	178,767	5,939
Total..............................	....	812,099	....	745,505	....	66,594

Ore was produced by 56 mine operators in 1909 and amounted to 57,587 tons, which was 4,100 tons less than was mined by 52 operators in 1908. The total average value per ton of the ore decreased from $13.14 in 1908 to $12.84 in 1909, and the gold and silver average value per ton decreased from $11.22 to $11.12. The largest part of the ore was treated at concentration mills and aggregated 32,800 tons, yielding 1,992 tons of concentrate, which contained 294.43 ounces of gold, 200,271 ounces of silver, 13,346 pounds of copper, and 338,298 pounds of lead, with a total value of $126,509 and an average value per ton of $63.51. Smelters received 24,514 tons of the total output, which contained 4,724.06 ounces of gold, 825,965 ounces of silver, 228,309 pounds of copper, and 1,230,398 pounds of lead, having a total value of $609,744 and an average value of $24.87 per ton. The remainder of the output yielded gold and silver bullion by the use of amalgamation and cyanide methods. Part of the bullion was the result of the treatment of tailing in the Elkhorn district. The placer production was valued at $5,966, as against $1,617 in 1908 and $2,950 in 1907. The concentrator at Basin, owned by the La France Copper Company, was put in operating condition the latter part of 1909 to receive the low-grade silver-zinc ores, of which 175 tons per day were shipped for concentration from the Butte-Superior mines, at Butte.

Amazon district.—The total production was made by 4 deep-mine operators and aggregated 74 tons of ore shipped directly to the smelters, which yielded $238 in gold, 1,245 ounces of silver, 1,329 pounds of copper, and 21,155 pounds of lead, valued at $1,968, with an average value of $26.59 per ton. In 1908 the average value of 55 tons of ore was $27.58 per ton. The principal shipments were made from the West Noble property.

Boulder district.—Three deep mines and 2 placers produced $630 in gold, 3,557 ounces of silver, 4,655 pounds of copper, and 6,930 pounds of lead, having a total value of $3,383. This output was almost entirely from 168 tons of shipping ore, with the exception of $481 in gold and 4 ounces of silver, which was produced from placer operations. The principal producers were the Baltimore, Grand View, and Union mines.

Cataract district.—The output of this district in 1909, from 11 deep mines and 4 placers, was $45,142 in gold, 66,569 ounces of silver, 37,733 pounds of copper, and 60,397 pounds of lead, valued in all at $87,260. The total ore produced, 2,910 tons, was divided into 2,887 tons of smelting ore and 23 tons of ore treated at an amalgamation mill. The smelting ore contained 2,140.73 ounces of gold, 65,758 ounces of silver, and all of the copper and lead. The placer yield was $602 in gold and 6 ounces of silver. Among the principal deep mines producing were the High Ore, Columbia, Comet, Crystal, and Atlantis. The largest shipments of crude ore were made from the Ruby mine and contained principally gold and silver.

Colorado district.—Nine deep mines and 3 placers yielded $3,889 in gold, 49,761 ounces of silver, 111,177 pounds of copper, and 173,906 pounds of lead, valued at $51,695. All of this product, with the exception of $306 in gold and 9 ounces of silver, which was credited to placers, was the yield of 1,884 tons of ore shipped to smelters. The principal producers were the Blue Bird, Boston-Alta, Corbin Copper, Minnesota, Silver Hill, Blue Bell, and Blizzard mines. The Corbin Copper Company, owning property 2 miles west of Wickes, has completed the foundation of its concentrator and expects to have it in operation during April, 1910. The Robert Emmet mine, one of the first mines in the district to be equipped with electrical machinery, has been connected with the electric power line of the United Missouri River Power Company. Surrounding the Bertha claim are 9 others owned by the Boston-Corbin Company, and extensively developed in 1908 and 1909. The Bertha mine is opened by shaft and tunnels to the 700-foot level. The ore, containing copper and silver, occurs in fissures in granite, which is said to be similar to that of the Butte district. It is expected the ore produced under active mining conditions will average 75 pounds of copper and 5 ounces of silver per ton. The shaft of the Boston-Alta mine has reached a depth of 400 feet. It has been in the hands of lessees during 1909, but the leases have since been terminated. The company has taken the property in charge and expects to mine the large low-grade ore deposits, which formerly were considered too low in value to work. Up to the suspension of operations in 1893, the property was worked principally for gold, silver, and lead. In the lower levels the lead is said to have been largely replaced by copper. The mine is credited with having produced 1,250,000 tons of ore, netting $32,000,000 previous to 1893, and up to that time only the highest grade ore was shipped.

Elkhorn district.—The tonnage of ore produced from 7 deep mines in the district increased from 48,064 tons in 1908 to 52,082 tons in 1909. The metal output in 1909 was $53,662 in gold, 897,865 ounces of silver, 84,055 pounds of copper, and 1,226,047 pounds of lead, with a total value of $584,119. About two-thirds of the ore was milled, producing lead concentrate high in silver, with a little copper and gold. Some of the ore was valuable at the copper smelters as converter lining. Oxidized iron ore was produced from the C. & D. and the Golden Curry mines. The principal part of the ore produced came from the Elkhorn mine. The Elkhorn Electro Metal Company erected its testing plant and is said to have made a successful extraction of gold and silver from old tailings.

Lump Gulch district.—Sixteen deep mines produced 326 tons of ore, valued at $9,284 for gold, silver, copper, and lead, of which 290 tons were shipped directly to the smelters, containing 42.70 ounces of gold, 11,485 ounces of silver, 1,447 pounds of copper, and 40,352 pounds of lead. A small tonnage of ore was treated at an amalgamation mill, and some gold and silver was produced from 1 placer in the district. The King Solomon was the largest producer of silver-lead ore, and other producers were the Capitol, Gold Crown, Last Hope, Mammoth, White Pine, and Raymond mines.

Mitchell district.—Two placer operators reported the production of gold and silver. The average fineness of the gold found in Mitchell Gulch in 1909 was 0.870 and of the silver 0.122.

Whitehall district.—Nearly all of the ore produced in 1909 was shipped by 6 deep-mine operators to smelters and aggregated 141 tons, containing $1,186 in gold, 626 ounces of silver, 1,259 pounds of copper, and 39,909 pounds of lead. The placer production reported by 5 operators aggregated $2,515 in gold and 17 ounces of silver. The total ore and placer output of the district was valued at $5,939. The Columbia, Cardwell, and Gold King mines were the principal producers.

LEWIS AND CLARK COUNTY.

Mine production of gold, silver, and associated metals in Lewis and Clark County, Mont., in 1908 and 1909.

Metal.	1908.		1909.		Decrease.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
PLACERS.						
Gold....fine ounces..	923.14	$19,083	821.74	$16,987	101.40	$2,096
Silver....do....	260	138	185	96	75	42
DEEP MINES.						
Gold....fine ounces..	9,654.73	199,581	5,759.62	119,062	3,895.11	80,519
Silver....do....	107,861	57,166	33,566	17,455	74,295	39,711
Copper....pounds..	22,660	2,991	5.798	754	16,862	2.237
Lead....do....	1,237,518	51,976	293,285	12,611	944,233	39,365
Total....	....	330,935	....	166,965	....	163,970

Reports from 64 mines in 1909, against 44 in 1908, for the deep mines of this county, gave a yield of 23,716 tons of ore, which was 9,021 tons less than that reported in 1908. The total value per ton of this ore decreased from $9.52 in 1908 to $6.32 in 1909, and the average value of the gold and silver content decreased from $7.84 to $5.76 per ton. Nearly all of the ore mined, amounting to 22,260 tons, was siliceous in character, and there were 1,424 tons of lead ore. Of the total ore produced, 18,273 tons were treated at mills equipped for amalgamation and cyanidation. In addition, there were treated by the cyanide process 3,408 tons of old tailings. The yield of bullion from ore and tailings amounted to 4,630.49 ounces of gold and 13,717 ounces of silver. A small tonnage of concentrate was made at one mill. The ore shipped directly to smelters aggregated 2,035 tons, containing 1,081.20 ounces of gold, 19,790 ounces of silver, 5,658 pounds of copper, and 292,920 pounds of lead, valued at $45,973 and averaging $22.59 per ton. There were 37 placer producers in 1909, against 33 in 1908. The output from this source aggregated $16,987 in gold and 185 ounces of silver, against $19,083 in gold and 260 ounces of silver in 1908.

Bald Butte district.—The principal mine producing was the Bald Butte, from which was shipped smelting ore containing gold, silver, copper, lead, and some bullion produced from its amalgamation mill. Some of the old tailings in the district were treated by lessees, using the cyanide process.

Big Blackfoot district.—A small tonnage of gold quartz was treated by the amalgamation process and resulted in the shipment of gold and silver bullion produced by one property in the district.

Dry Gulch district.—Two deep mines and six placer mines yielded a product valued at $10,083. Of the total production of ore, amounting to 114 tons, and containing principally lead and silver, all but 6 tons was shipped to smelters. The total placer output in 1909 amounted to $5,442 in gold and 38 ounces of silver.

Greenhorn district.—The output of the district was very small in 1909 and consisted of gold ore and an ore containing lead, copper, and silver. Shipments made were considered as tests and the ore was taken out in the development of the properties.

Helena district.—The total output of the district was valued at $13,525 in 1909, as against an output valued at $15,540 in 1908. The production recorded in 1909 from 20 deep mines and 12 placer operators aggregated $11,158 in gold, 2,628 ounces of silver, 503 pounds of copper, and 21,769 pounds of lead. The ore produced, 570 tons in quantity, was almost equally divided between that shipped to smelters and that treated at mills, using the amalgamation process. The ore shipped to smelters, aggregating 238 tons, yielded 237.31 ounces of gold, 2,574 ounces of silver, and all of the lead and copper. The placers produced $2,758 in gold and 14 ounces of silver. Among the principal deep-mine producers were the McIntyre, None Such, Old Dominion, and Arrowhead mines.

Lincoln district.—Four operators of placers produced $1,551 in gold and 6 ounces of silver. The average fineness of the gold produced in the district in 1909 was 0.914. The Eglanol Company, operating the Lincoln Gulch placers, commenced operations in November and a small production resulted from development work.

Ottawa district.—Of the 15,762 tons of ore produced by 15 mine operators in 1909, 12,291 tons were treated at milling plants, producing bullion and a small quantity of concentrate. In addition to this ore treated, 3,408 tons of tailings produced bullion, which was included in the total of 2,732.12 ounces of gold and 12,826 ounces of silver. Only 63 tons were shipped to smelters and 10 tons of concentrate produced, containing copper and lead, from the district in 1909. From placer operations two small productions were reported. The total yield of the district was valued at $65,885, against a total of $18,796 in 1908. Among the producers were the Bald Mountain, Piegan-Gloster, Nile-Towsley, and lessees working on one of the old mines. Tailings were worked from along Canyon Creek by several operators of cyanide plants.

Poorman district.—The production by three placer operators amounted to $340 in gold and silver. The average fineness of the gold produced was 0.856.

Stemple district.—The Bell Boy, New Year, and Klondyke mines were producers of 52 tons of ore, the larger part of which was treated at amalgamation mills, and the remainder shipped to smelters. Placer production from three sources yielded $194 in gold and 2 ouuces of silver.

Springhill and Unionville districts.—The output of 6 deep mines and 3 placer producers was valued at $35,480, mainly in gold. Of the total ore produced, 4,976 tons, nine-tenths was milled, producing gold and silver bullion and some concentrate; and 314 tons of ore were shipped directly to the smelters. The latter contained 390.83 ounces of gold, 417 ounces of silver, 829 pounds of copper, and 3,218 pounds of lead. The principal producer was the Whitlatch mine, which is equipped with a 20-stamp amalgamation mill. The property was operated for three months.

Vaughn district.—In 1909 the total value of the district output made by 12 deep mines and 4 placers was $23,940, of which $11,265 was for gold, as against an output made by 5 deep mines and 6 placers, valued at $132,648, in 1908. The tonnage of ore mined in 1908 was 5,674 tons, and in 1909, 1,217 tons. Of the total tonnage produced in 1909, 1,213 tons were shipped directly to smelters and yielded 336.66 ounces of gold, 14,197 ounces of silver, 936 pounds of copper, and 119,061 pounds of lead. Reports received from four placer operators gave a total production of $4,135 in gold and 96 ounces of silver, the gold having an average fineness of 0.635. The deep mines operating and producing were the Mary Alloys, Lee Mountain, Transit, and Valley Forge. The principal metals produced were lead and silver. Among the placers, the Dynamite, Perseverance, Monitor, and Last Dollar were productive.

LINCOLN COUNTY.

This county, which was part of Flathead County in 1908, was credited with a total production valued at $2,377 in 1909, of which $2,198 was for gold from placers and deep mines. Libby district was the only district in which there were active operations. The Blacktail mine and the 10-stamp mill were operated by lessees. Shipments of ore were made from the Snowshoe mine to the railroad station, but were not shipped until early in 1910. A lessee worked the Silver Crown mine and shipped a small quantity of lead ore. Active development work was kept up on the placers, in building flumes and preparing for production.

Some work was started in the Sylvanite district in opening a gold property, to which material for a stamp mill to be erected in 1910 was being hauled.

MADISON COUNTY.

Mine production of gold, silver, and associated metals in Madison County, Mont., in 1908 and 1909.

Metal.	1908.		1909.		Increase.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
PLACERS.						
Gold..........fine ounces..	20,072.67	$414,939	20,700.97	$427,927	628.30	$12,988
Silver..........do....	3,238	1,716	3,328	1,731	90	15
DEEP MINES.						
Gold..........fine ounces..	8,351.61	172,643	12,658.04	261,665	4,306.43	89,022
Silver..........do....	31,839	16,875	88,530	46,035	56,691	29,160
Copper..........pounds..	21,268	2,807	22,491	2,924	1,223	117
Lead..........do....	190,617	8,006	191,045	8,215	428	209
Total..........	....	616,986	....	748,497	....	131,511

The placer mines of this county in 1909 were credited with the largest yield of gold in the State, and its deep mines rank fourth in the total production of gold. The output of ore, aggregating 21,622 tons, produced by 105 operators, is 9,950 tons greater than in 1908, when 90 operators reported. With the increase in tonnage, the total value per ton decreased from $17.16 in 1908 to $14.75 in 1909, and the gold and silver value from $16.23 to $14.23 per ton. The total output of ore was divided into 21,111 tons of siliceous or dry ore, 501 tons of lead ore, and 10 tons of copper ore. The greater part of the tonnage was treated at amalgamation mills, where 17,191 tons yielded bullion containing 2,503.64 ounces of gold and 26,358 ounces of silver. Nearly all of the mills were equipped with concentrators, and in addition to the bullion, there were produced 724 tons of concentrate containing 2,533.92 ounces of gold, 23,995 ounces of silver, and 11,547 pounds of copper, in all valued at $66,359 and averaging $91.62 per ton. The smelters received 4,307 tons, yielding 7,620.49 ounces of gold, 38,177 ounces of silver, 10,944 pounds of copper, and 191,045 pounds of lead, valued at $187,019, with an average value of $43.44 per ton. The placer output in 1909 aggregated $427,927 in gold and 3,328 ounces of silver. The production from placers in 1908 was $414,939 in gold and 3,238 ounces of silver and was double the output of 1907.

Alder Gulch district.—This district is credited with the largest part of the placer gold output of the county, which was produced principally by the Conrey Placer Mining Company, operating the Poor Farm and Conrey placers. The fineness of the gold is between 0.835 and 0.858. The first successful gold-dredging operations on a large scale in Montana are credited to this company, whose three bucket dredges are near Ruby, in Alder Gulch. The dredges are electrically equipped and have a combined capacity of 350,000 cubic yards per month, based on actual operation. The ground worked is from 30 to 40 feet deep, the buckets cutting 1 to 4 feet into the bed rock. Gold in this ground is said to average about 20 cents per cubic yard. A number of other placers were operated by hydraulic and sluicing methods. The ore produced from deep mines aggregated 445 tons. The larger part, or 309 tons, containing 549.79 ounces of gold, 8,690 ounces of silver, and 1,910 pounds of copper, was shipped to smelters. The remainder of the ore output was treated at an amalgamation mill. Ore was shipped from the Bamboo Chief, U. S. Grant, High Tariff, and Prospect mines.

Lower Hot Springs district.—Five deep-mine operators reported a production of 136 tons of ore, all of which was shipped to smelters and yielded $2,880 in gold, 221 ounces of silver, with a total value of $2,995 and an average value of $22.02 per ton. The Birdie, Michigan, and Red Bluff claims were producers.

Mineral Hill district.—The output of 15 deep mines aggregated 7,474 tons in 1909, the greater part of which, or 6,661 tons, was treated at mills equipped for concentration and amalgamation. The remainder of the output, 689 tons, was shipped directly to the smelters. The total yield of the ore produced in the district was $88,555 in gold, 3,891 ounces of silver, 9,925 pounds of copper, and 1,145 pounds of lead, valued at $91,917, an average of $12.30 per ton. In 1908 the output from 12 deep mines was 5,796 tons, which averaged $9.95 per ton. The Boss Tweed-Clipper, Mammoth, Oregon, Pony, Strawberry, White Pine, Ben Harrison Fraction, and Mount Meadow mines were producers.

Norwegian district.—Two mine operators in 1909 against 4 reporting in 1908 were credited with a production of 101 tons of ore, all of which was shipped to the smelters and yielded $2,571 in gold, silver, and copper at an average value per ton of $25.45. In 1908 the average value of 135 tons was $60.01 per ton.

Ramshorn district.—The total output of the district by 2 deep mines and 6 placer operators aggregated $3,717 in gold and 1,701 ounces of silver, having a total value of $4,601. With the exception of $2,504 in gold and 20 ounces of silver from placers the output was the yield of 109 tons of ore shipped to smelters. The Snowshoe, Harris Gulch, Ground Hog, Lofton & Thompson, Holst, and Weasel placers were producers during the year.

Rabbit district.—Reports were received from 8 deep mines and 1 placer. All of the ore produced was shipped to smelters. The total output was 291 tons of ore and $6,100 in gold, 1,470 ounces of silver, 18 pounds of copper, and 18,700 pounds of lead. The deep mines producing were the King, Blue Bird-New, Thistle, Watseca, Anything, and Gillfoy.

Sand Creek district.—Near Sappington, the Python and Whip-poor-will claims yielded a few tons of ore containing gold and silver, which was shipped to smelters.

Sheridan district.—Nine deep mines and 1 placer in 1909 yielded $10,985 in gold, 1,295 ounces of silver, 1,069 pounds of copper, and 2,128 pounds of lead, with a total value of $11,889. Of the total output, 176 tons were shipped to smelters and 136 tons were treated at amalgamation mills. The Bell, Bonanza, Noble No. 1, Red Pine, and Tamarack mines were the principal producers.

Silver Star district.—Ten mine operators reported the output of 990 tons of ore, of which 960 tons were shipped directly to smelters and yielded 1,565.22 ounces of gold, 2,253 ounces of silver, 2,891 pounds of copper, and 13,130 pounds of lead. The remainder of the ore, or 30 tons, was treated at an amalgamation mill. The total output of the district was valued at $34,780, an average value of $35.13 per ton. In 1908 the production from 11 mines was 1,049 tons of ore with an average value of $34.05 per ton. The principal producers were the Hudson, Broadway, Stella, White Elephant, Moonlight, Moose Ledge, and Greene-Campbell properties.

Summit district.—The production of ore made by 11 deep-mine operators aggregated 7,485 tons. The largest part of this output, 6,838 tons, yielded 900.18 ounces of gold, 25,456 ounces of silver, and 237 tons of concentrate, which contained 1,320.46 ounces of gold, 22,358 ounces of silver, and 2,863 pounds of copper. The remainder of the ore, 647 tons in quantity, was shipped directly to smelters. The total value of the production of 1909 was $96,232, as against a total value of $22,030 in 1908. The placer production of $2,408 in gold and 27 ounces of silver is included in the above totals. The largest producer of ore was the Easton mine. Important tonnages were also mined from the Elfleda, Fortune, Homestake, Mapleton, Oro Cache, Winnetka, and Adopted Kid properties.

Tidal Wave district.—Nineteen deep-mine operators reported the production of 438 tons of smelting ore and 30 tons of ore treated at an amalgamation mill, which had a total yield of $15,596 in gold, 10,056 ounces of silver, 882 pounds of copper, and 155,942 pounds of lead, having a total value of $27,646, and an average value of $59.07 per ton. In 1908 there were 13 mines producing 1,454 tons of ore, which averaged $15.25 per ton. The principal producers of the district in 1909 were the Argenta, Carolina, Ella, Goodrich, Keynote, Little Goldie, Lottie, Legal Tender, Sunflower, Star, Topeka, Van Meter, and Liberty mines; and small shipments were made from various other properties.

Upper Hot Springs district.—From 11 deep mines was reported an aggregate output of 3,637 tons. The larger part, or 3,300 tons, was treated at milling plants, yielding bullion containing 576.92 ounces of gold and 558 ounces of silver. The remainder of the ore, or 337 tons, containing 336.54 ounces of gold, 773 ounces of silver, and 923 pounds of copper was shipped to smelters. The total ore was valued at $19,695, an average of $5.41 per ton. The producers were the Balmoral, Tennessee, Monitor-Revenue, New York Bell, and Thorn Fraction.

Washington Gulch district.—This district was credited with a production of ore valued at $5,412, the output of 3 deep mines. The Lehigh No. 4 and George McKee mines were the principal producers in 1909. The former is equipped with a 10-stamp concentration and amalgamation mill.

MEAGHER COUNTY.

Operators of 4 properties reported in 1909 an output of 92 tons of ore, containing $458 in gold, 25 ounces of silver, and 30,805 pounds of copper, valued at $4,476, an average value of $48.65 per ton. Placers produced $259 in gold and 1 ounce of silver. In 1908 the output by the same number of producers was 176 tons of ore with a total average value per ton of $31.41. The producers of the county were the Clara Barton, Porcupine, and Gile Placer, in the Musselshell district, and the Morning Star in the Nuemansville district.

MISSOULA COUNTY.

Mine production of gold, silver, and associated metals in Missoula County, Mont., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
PLACERS.						
Gold........fine ounces..	1,496.58	$30,937	1,223.06	$25,283	−273.52	−$5,654
Silver........do....	57	30	49	25	− 8	− 5
DEEP MINES.						
Gold........fine ounces..	.24	5	33.77	698	+ 33.53	+ 693
Silver........do....	25	13	1,392	724	+ 1,367	+ 711
Copper........pounds..	4,713	622	784	102	− 3,929	− 520
Lead........do....	....	....	31,392	1,350	+31,392	+ 1,350
Zinc........do....	....	....	60,570	3,271	+60,570	+ 3,271
Total........	....	31,607	....	31,453	....	− 154

Four deep mine and 19 placer operators in 1909 reported production, against 1 deep mine and 18 placer operators in 1908. The ore produced aggregated 162 tons, an increase of 152 tons over that produced in 1908. The placer output, valued at $30,967 in 1908, decreased to $25,308 in 1909.

Cedar Creek district.—Fourteen placer operators in 1909 produced an aggregate output of gold and silver valued at $17,755, which included the production of one dredge operated on Cedar Creek. The producers were the Basin, California, Deep Gulch, Twenty to One, Meadow Creek, Montana, Gold, Ohio, Stockholm, Sunrise, and C. B. and Q. placers. The La Casse placers were operated by the Kansas City Commerical Company, owning the only dredge in the district. The dredge is of the Marion-stacker type, of a capacity of 3,000 yards, and is electrically operated. It is reported that the pay streak of the ground samples about 25 cents per cubic yard. The gold ranges in fineness from 0.938 to 0.955.

Iron Mountain district.—In performing development work, the Iron Mountain Tunnel Company shipped two lots of lead-zinc ore. The mine is opened by a vertical shaft 1,750 feet deep and by adits 5,603 feet long.

Nine Mile district.—Five placer operators reported the production of $7,550 in gold and 6 ounces of silver, against a production made in 1908 of $6,363 in gold and 6 ounces of silver. Some of the properties have been leased to Chinamen during the last two years. Some of the gold found as nuggets is particularly sought after by jewelers and traders, and an estimated amount of such gold sold during the year has been included in the output of the district. Properties actively developing and producing were the Chrysalis, Kennedy Creek, Tom Tom, and Slide placers. The Josephine mine received steady development during 1909 and is reported to expose ore containing copper, silver, and lead.

St. Regis district.—Shipments were made from 2 deep mines, which produced lead ore sent to the smelters as tests. A number of properties are under development with promising results.

Saltese district.—The Inland mine was developed during the year, and a trial shipment of copper ore was made to the smelter. Many properties are under development with varying results.

PARK COUNTY.

Old tailings from the Revenue mill were re-treated, yielding gold and silver contained in precipitates and concentrate. The placer output was small, the operators reporting a production valued at $137. In 1908 the output consisted of $1,335 in gold and 6 ounces of silver.

POWELL COUNTY.

Mine production of gold, silver, and associated metals in Powell County, Mont., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
PLACERS.						
Gold......fine ounces..	2,395.58	$49,521	1,365.19	$28,221	−1,030.39	−$21,300
Silver......do....	251	133	171	89	− 80	− 44
DEEP MINES.						
Gold......fine ounces..	486.07	10,048	825.81	17,071	+ 339.74	+ 7,023
Silver......do....	18,243	9,669	13,221	6,875	− 5,022	− 2,794
Copper......pounds..	48,494	6,401	81,791	10,633	+ 33,297	+ 4,232
Lead......do....	120,671	5,068	29,159	1,254	− 91,512	− 3,814
Total......	......	80,840	......	64,143	......	− 16,697

The production of ore reported by 23 mine operators in 1909 aggregated 1,140 tons, which was 292 tons greater than the output reported by 12 operators in 1908. The total average value per ton decreased from $36.77 in 1908 to $31.43 in 1909, and the total average value per ton of the gold and silver in this ore decreased from $23.25 to $21. The total output was divided in 1909 into 558 tons of siliceous ore, 350 tons of copper ore, and 232 tons of lead ore. Shipments to the smelters consisted of 876 tons and yielded 714.31 ounces of gold, 13,197 ounces of silver, 81,791 pounds of copper, and 29,159 pounds of lead, the total valued at $33,515, an average value of $38.26 per ton. The remainder of the ore, consisting of 264 tons, was treated at amalgamation mills. There were 30 placer operators reporting a total yield of $28,221 in gold and 171 ounces of silver, as against a production in 1908 of $49,521 in gold and 251 ounces of silver.

Big Blackfoot district.—The district extends into Lewis and Clark County, one operator reporting from that region. The total output from the district on the Powell County side, reported from 2 deep mines and 3 placer operators, aggregated $1,529 in gold and 56 ounces of silver. Half of the output shipped contained a very small quantity of copper and the remainder was treated at an amalgamation mill. Included in the totals are $1,041 in gold and 7 ounces of silver produced by placers. The placers producing were the Carmen, Northwestern, and Moose Creek. The Trapper mine and the 5-stamp mill on the property were operated.

Coloma district.—Only 2 deep-mine operators reported a small production, which contained principally gold and silver.

Ontario district.—The reports received from 6 deep-mine and 2 placer operators indicated a yield of $6,422 in gold, 4,083 ounces of silver, 8,677 pounds of copper, and 21,065 pounds of lead, with a total value of $10,580. Included in this output were $299 in gold and 1 ounce of silver, the production of the placers. The ore mined consisted of 328 tons, of which 325 tons were shipped to smelters. The remainder represented a test at an amalgamation mill. The largest producers were the Big Dick and the Monarch mines.

Ophir district.—The production of 7 deep mines and 10 placers aggregated $8,313 in gold, 6,749 ounces of silver, and 70,019 pounds of copper, the total valued at $20,925. Of 366 tons of ore mined, 345 tons were shipped to smelters and 21 tons were treated at an amalgamation mill. The totals include $3,221 in gold and 16 ounces of silver, which was the production of placers. The principal deep mines operating were the Elliston Copper, Fairview, Ladysmith, Wall Street, and Victory, and the principal placers were the Carpenter Basin, Comet Bar, Davis, Eureka, Loraine, Tomera, and Ward.

Pioneer district.—The total output of the district, reported from 1 deep mine and 7 placers, aggregated $21,883 in gold and 197 ounces of silver. A small quantity of copper was contained in a shipment to the smelter. The total output was valued at $21,994. The output of the district in 1908 consisted of $36,734 in gold and 208 ounces of silver. The placers operating were the Upper Gold Creek, Gold Creek Falls, Kohrs and Bielenburg, Pure Gold, Oro Fino, and Friday.

Washington Gulch district.—From 1 deep mine and 7 placers was reported an aggregate production of $4,211 in gold and 49 ounces of silver. Part of the gold was produced as bullion from an amalgamation mill. The placers operating were the Eureka Gulch, Ferris, Ruther, Scotch Bar, and Wilson Bar. The Mutual mine and 5-stamp mill, located 24 miles from Avon, were operated.

Zozell district.—Operators of 3 deep mines produced lead ore containing gold and silver.

RAVALLI COUNTY.

On Hughes Creek the Wood placer was operated and produced gold having a fineness of 0.923. There were other productions from smaller operators, which made the output total $4,308 in gold and 17 ounces of silver, against an output consisting of $2,068 in gold and 7 ounces of silver in 1908.

SANDERS COUNTY.

Deep mines producing in the county yielded small quantities of shipping ore containing gold, silver, copper, and lead. Shipments from the King and Queen group, in the Spring Gulch district, were begun the latter part of the year.

SILVER BOW COUNTY.

Mine production of gold, silver, and associated metals in Silver Bow County, Mont., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold.......fine ounces..	32,005.84	$661,619	39,443.43	$815,368	+ 7,437.59	+ $153,749
Silver..............do....	8,500,729	4,505,386	10,609,328	5,516,850	+ 2,108,599	+1,011,464
Copper.........pounds..	250,150,712	33,019,894	311,323,650	40,472,074	+61,172,938	+7,452,180
Lead..............do....	597,819	25,108	199,056	8,559	− 398,763	− 16,549
Zinc...............do....	1,640,000	77,080	9,299,154	502,154	+ 7,659,154	+ 425,074
Total............	....	38,289,087	....	47,315,005	....	+9,025,918

The total number of mine operators in Silver Bow County was 71 in 1909 as against 102 in 1908. The decrease in number is attributed to several consolidations and a smaller number of lessees reporting individually. The output of ore aggregated 5,000,062 tons, which is 1,142,004 tons greater than in 1908. The total average value per ton decreased from $9.92 in 1908 to $9.46 in 1909, and the gold and silver value of this ore decreased from $1.34 to $1.26. The tonnage of copper ore was largely responsible for the increase, and aggregated 4,961,187 tons, against an output of 3,817,212 tons in 1908. The zinc ore produced increased from 28,133 tons in 1908 to 34,463 tons in 1909, and the lead ore from 19 tons to 315 tons. Production of siliceous or dry ore decreased from 12,694 tons in 1908 to 4,097 tons in 1909. The largest part of the total tonnage was treated at concentration plants, increasing from 3,028,007 tons in 1908 to 4,401,628 tons in 1909. The number of tons of concentrates produced also increased from 879,410 tons to 1,308,202 tons in 1909. The total value of the concentrate produced in 1909 was $37,508,032, an average of $28.67 per ton, as against an average of $29.52 per ton in 1908. The output of smelting ore produced, almost entirely of copper ore, but including a small quantity of lead ore, aggregated 569,084 tons in 1909, as against an output of 746,843 tons in 1908. The total value of the shipping ore in 1909 aggregated $8,719,726, an average value of $15.32 per ton. In 1908 the average value of the smelting ore was $15.89 per ton. Included in the metallic content of the smelting ores was the content of 29,335 tons of slag and flue dust; also included were the copper precipitates from mine waters and tailings. From the slag and flue dust 1,849,736 pounds of copper were recovered, and the copper precipitates contained 6,467,068 pounds of copper. The placer production of the county aggregated $5,867 in gold and 68 ounces of silver, against an output in 1908 of $3,256 in gold and 25 ounces of silver.

Divide Creek district.—The reports from 13 deep mines and 3 placers, which was an important increase over the number of operators in the district in 1908, gave an aggregate output of $6,301 in gold, 5,138 ounces of silver, 34,573 pounds of copper, and 3,388 pounds of lead, with a total value of $13,612. The larger part of the ore produced, or 242 tons, was of shipping grade and contained 276.15 ounces of gold, 5,134 ounces of silver, and all of the copper and lead in the above totals. Among the principal producers were the Climax, Black Jacket, Clipper-Columbia, Gold King, Lincoln, Combination, and Old Glory. The placers producing were situated in Soap Gulch.

German Gulch district.—Reports were received from 4 placer operators producing slightly more than $1,000 in 1909. The number was probably greater than that given, as the gold is produced in small quantities by transitory miners who trade their product to local merchants and bankers.

Summit Valley district.—The product reported for the county, with the exception of that given in the Divide Creek and German Gulch districts, represents the production of this region, which is better known as the Butte district. There were 58 properties producing in 1909. A great many lessees were working, but are not included in the list of operators as the company on whose property they worked reported the total production of that property for the year. The copper production in 1909 exceeded that of any previous year in the history of the Butte district. But for the December curtailment, due to the strike of railroad switchmen, the output would have been greater. Development work in 1909 also established a new record, especially in the mines under the new combination to be known as the Anaconda Copper Company, and the North Butte and Butte Coalition companies. The amount of money spent for development and betterments during 1909 has been unprecedented. A further expenditure of funds, said to be $2,000,000, will largely go into changes for greater economies at the mines and smelters, which will include a complete electric power equipment at the mines. Outside of the larger companies, an enormous amount of development work has been done by the Butte-Balaklava Copper Company, the Tuolumne Copper Company, and the Butte-Superior Company. The two former have developed their mines to a good producing stage. The Butte-Balaklava Company has completed its development down to the 1,400-foot level. The developments in the Anaconda Copper Company's properties consisted of sinking a new shaft on the Gagnon mine 360 feet, to be sunk 1,940 feet farther; the Leonard shaft, 1,800 feet, was being deepened; the Montana Consolidated shaft was 2,900 feet deep; at 2,596 feet the Diamond shaft, whose collar is below that of the Consolidated, is said to be the deepest at Butte; the Belmont shaft was 1,190 feet deep and sinking was continued; the Badger State shaft was 1,500 feet deep; the West Gray Rock shaft, 1,100 feet; the Little Mina shaft, 1,200 feet; and the Moonlight shaft, 1,500 feet. Altogether the development in the Anaconda Copper Company's properties consisted of 141,858 feet of new work during 1909. At the North Butte property, on the 2,000-foot and 2,200-foot levels, the Edith May vein has been productive, but it is said the ore is not so rich in copper at that depth as above. No mining was done on the Speculator vein. According to the annual statement of the Butte Coalition Mining Company, the Red Metal mines in 1909 produced 591,737 tons of copper ore and received payment for 33,438,490 pounds of copper, 594,626.11 ounces of silver, and 4,059.51 ounces of gold. During 1909 the Rarus shaft was sunk to the 2,200-foot level and the Tramway shaft to the 2,000-foot level. In the Minnie Healy claim, on its 1,400-foot level, 3 new veins were developed, their respective widths being 30, 10, and 5 feet. Shortly after the close of 1909, the daily output of ore from this mine had reached 1,200 tons and the output per man per day had reached 2.35 tons, the highest figure of this company's operations. The East Butte Copper Company has become one of the most important among the independent copper producers. It owns the Pittsmont mine and smelter and other important territory. Mining is mostly confined to the 800-foot level of the Pittsmont mine, though work is also going on in the 1,000-foot and 1,200-foot levels. One of the large ore bodies on the 800-foot level is some distance north of the shaft and another is about 2,000 feet to the west on the Silver Bow vein, where the ore deposit is fully 30 feet wide. The October shipments from this deposit averaged 6 per cent of copper. At the East Butte claims, mining is confined to the 400-foot and 600-foot levels. The company leases its precipitating plant, producing copper precipitates from the old Parrot smelter dump. At the smelter the company treats its own ore and considerable custom material. It plans to devote one of its furnaces entirely to custom ore. Development work was resumed in the Raven Mine and the early resumption of work on the Ophir mine of the Butte Central Copper Company was looked forward to in 1910. On the east side of the Butte district, the Sarsfield mine, situated at the mouth of Park Canyon near the Pittsmont mine, became a producer the last part of 1909. Zinc ores in considerable quantities have been found from time to time in various producing copper mines of Butte, but such ore has been more valuable for copper and silver than for the zinc it contained and no effort has been made to recover the zinc. In the treatment of the zinc ore it is found necessary to crush the ore much finer than is the practice with the copper ore. This has been demonstrated with the ores from the Elm Orlu and Black Rock mines. The ore readily concentrates up to above 40 per cent of zinc, and will carry in addition from 3 to 4 per cent of copper and from 20 to 30 ounces of silver and from $1 to $2 in gold per ton. The concentration plant at the Butte Reduction Works has a capacity of about 300 tons of zinc ore per day. All of the Elm Orlu ores were treated at this plant. A gravity tramway has been built from the Black Rock mine of the Butte-Superior group to its ore bins, from which low-grade silver-zinc ore will be carried by the Great Northern

Railway to the mill at Basin, in Jefferson County. This will have the effect of doubling the shipments of zinc ore, which at the close of the year were 175 tons daily. The Emma mine, an old copper producer which has long been idle, is now owned by the Butte Copper and Zinc Company, which is preparing to unwater the 1,200-foot shaft of the mine to the 200-foot level. It is said that the ore carries a high percentage of zinc, which is the metal sought in the present operations. Operations of the large gold dredge of the British Butte Company at Rocker, near Butte, were suspended in October. The work under new management is confined to prospecting and a bore-hole was started from the bottom of the 670-foot shaft on the property in an effort to find bed rock. It is said that the gold value continues uniform to the bottom of the bore, which was 500 feet deep at the close of 1909.

NEVADA.

By Chester Naramore.

PRODUCTION.

The total value of the production of gold, silver, copper, lead, and zinc in Nevada for the calendar year 1909 was $30,072,932, which was an increase of $11,254,704, or 60 per cent, over the corresponding value for 1908. The gold yield of $16,239,963 furnished over one-half of the total value produced, and nearly $5,000,000 of the total increase. The yield of all five metals showed large increases for 1909, but the value of the copper output increased nearly $5,500,000, and exceeded the value of the silver production of the State by nearly $2,000,000. Thus copper ranked second in value for the first time.

The silver production was 10,981,061 fine ounces, or 1,472,597 fine ounces more than in 1908, a 15 per cent increase.

The lead output of 9,840,791 pounds was an increase of 2,595,172 pounds, or 36 per cent, and the zinc yield of 3,013,352 pounds was nearly three times as large as in 1908. The following table states the production for 1908 and 1909 with increase in quantity and value for each metal:

Mine production of gold, silver, and associated metals in Nevada in 1908 and 1909.

Metal.	1908.		1909.		Increase.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold.............fine ounces..	549,682.27	$11,362,941	785,608.21	$16,239,963	235,925.94	$4,877,022
Silver....................do....	9,508,464	5,039,486	10,981,061	5,710,152	1,472,597	670,666
Copper................pounds..	15,598,788	2,059,040	57,976,477	7,536,942	42,377,689	5,477,902
Lead......................do....	7,245,619	304,316	9,840,791	423,154	2,595,172	118,838
Zinc.......................do....	1,115,851	52,445	3,013,352	162,721	1,897,501	110,276
Total..................	....	18,818,228	....	30,072,932	....	11,254,704

ORE PRODUCTION.

There were 417 producing mines in Nevada in 1909, including 41 placers. From the 376 deep mines 2,982,607 tons of ore were mined which yielded a total recovery of $29,989,169, or an average saving of $10.05 per ton in all five metals and $7.33 per ton in gold and silver.

In 1908 there were 1,425,532 tons of ore produced which averaged $13.20 per ton in total values and $11.45 per ton in gold and silver values. The decreased value per ton in 1909 resulted from the greatly increased tonnage of concentrating ore milled at Ely in 1909.

Increases were made in all classes of ore mined, except in copper-lead ores, which decreased about one-half. Siliceous ore increased from 951,880 tons in 1908 to 1,229,651 tons in 1909 and yielded $15,471,481 in gold and $4,917,557 in silver, or an average recovery of $16.58 per ton in precious metals, the same as in 1908. The mines of Esmeralda and Nye counties were the source of most of this ore, and the Goldfield district furnished most of the increase.

There were 1,670,457 tons of copper ores mined in 1909, nearly four times as much as in 1908. This ore carried $365,671 in gold and $38,801 in silver values, or an average of $0.24 per ton in precious metals, a decrease of $0.02 per ton. This important increase in tonnage was made by the larger companies in the Ely district, Whitepine County.

Production of lead ores more than doubled in 1909, amounting to 76,837 tons, an increase of 42,082 tons. The lead ores yielded $319,507 in gold and $736,016 in silver, or an average of $13.74 per ton in gold and silver values as compared with $11.56 per ton in 1908. The mines of the Eureka district were the source of the bulk of this increase.

The zinc-ore tonnage increased from 1,793 tons in 1908 to 2,882 tons in 1909, and carried no precious-metal values, but the 1,759 tons of lead-zinc ore averaged $5.08 per ton in gold and silver.

There were 1,021 tons of copper-lead ores shipped, less than half as much as in 1908, and the gold and silver content averaged $8.21 per ton, as compared with $10.05 per ton in 1908. The following table shows the tonnage of the different classes of ore sold or treated in 1909, with the average value per ton in gold and silver for each kind, and the increase and decrease in tonnage:

Subdivision of tonnage of ore sold or treated in Nevada in 1909, by counties, in short tons.

County.	Dry or siliceous ore.	Copper ores.	Lead ores.	Zinc ores.	Copper-lead ores.	Lead-zinc ores.	Total.
Churchill	1,173		38				1,211
Clark	72,959		48	2,882		1,759	77,648
Douglas and Ormsby	48	23					71
Elko	10,721	150	1,243		80		12,194
Esmeralda	460,116	155	8,432				468,703
Eureka	27,326	50	60,946		19		88,341
Humboldt	11,399	22	123				11,544
Lander	2,013		44		23		2,080
Lincoln	99,816		3,470		899		104,185
Lyon	18,551						18,551
Nye	426,089	47	285				426,421
Storey	92,092						92,092
Washoe	4,238						4,238
Whitepine	3,110	1,670,010	2,208				1,675,328
Total	1,229,651	1,670,457	76,837	2,882	1,021	1,759	2,982,607
Increase (+) or decrease (−)	+277,771	+1,235,570	+42,082	+1,089	−1,196	+1,759	+1,557,075
Average value per ton in gold and silver	$16.58	$0.24	$13.74		$8.21	$5.08	$7.33

The 1,052,723 tons of ore treated in gold and silver mills yielded $11,720,240 in gold and $3,369,364 in silver, or a total bullion product of $15,089,604, an average recovery of $11.13 per ton in gold, $3.20

per ton in silver, and $14.33 per ton in both metals. From the above mill ore 13,234 tons of concentrates were derived, which yielded $1,166,569 in gold, 773,469 fine ounces of silver, 53,622 pounds of copper, and 12,443 pounds of lead. This represented an average total recovered value of $119.11 per ton of concentrates, of which $88.15 per ton was gold and $30.39 per ton was value of silver. Thus there was a total yield from the 1,052,723 tons of crude ore sent to gold and silver mills of $16,665,883, or an average of $15.83 per ton, of which $12.24 per ton was gold and $3.58 per ton was silver. Esmeralda and Nye counties furnished most of this type of ore.

The tonnage of ore sent direct to concentrating mills in 1909, representing over 56 per cent of the total ore mined in Nevada, aggregated 1,684,103 tons, and yielded 198,453 tons of concentrates, a reduction of approximately 8.5 tons into 1. The concentrates yielded 54,908,200 pounds of copper, valued at $7,138,066; $587,860 in gold; 323,998 fine ounces of silver, valued at $168,479; and 50,930 pounds of lead, valued at $2,290; or a total average recovery valued at $39.79 per ton. This was equivalent to a yield of $4.69 per ton of crude ore. Ely district was the source of about 98 per cent of this class of ore.

There were 180,386 tons of crude ore shipped to smelters, yielding $2,476,375 in gold; 3,359,866 fine ounces of silver, valued at $1,747,130; 3,014,655 pounds of copper, valued at $391,905; 9,777,418 pounds of lead, valued at $420,429; and 3,013,352 pounds of zinc, valued at $162,721. The total value of the smelter ore was $5,198,560, which was an average recovery of $28.82 per ton. The average yield per ton of ore was $13.73 in gold and $9.68 in silver, or $23.41 for gold and silver.

Re-treatment of 65,395 tons of old tailings and slags in 1909 made an additional recovery of $205,954 in gold and 42,648 fine ounces of silver, valued at $22,177, or a total value of $228,131, and an average yield of $3.49 per ton.

GOLD.

The total gold yield for Nevada in 1908 was 785,608.21 fine ounces, valued at $16,239,963, an increase for 1909 of $4,877,022, or 43 per cent. Esmeralda County, with a gold production of $10,521,862, was the source of 65 per cent of the State total, as well as the chief factor in the increased production, as the county increase was $4,536,792. White Pine, Eureka, Humboldt, and Clark counties also made notable increases, while Lincoln and Nye counties reduced their gold totals considerably.

Of this gold production of Nevada, $15,471,481, or 95 per cent, was won from dry or siliceous ore; $365,671 was recovered from copper ores; $319,562 was mined in lead ores; and the placer yield was $82,965. Of the 41 producing placer properties in 1909, the 20 mines in Manhattan and Round Mountain districts in Nye County yielded $60,876, or approximately three-fourths of the total placer product, and the 6 mines in Lynn district in Eureka County produced $14,856. Of the gold won from siliceous ores, nearly seven-tenths was mined in Esmeralda County and almost two-tenths was produced in Nye County. White Pine County furnished practically the entire yield of gold from copper ores in 1909, and most of the gold recovered from lead ores was shipped from Eureka County.

The gold produced as mill bullion amounted to $11,720,240, or more than 72 per cent of the total output. Of this quantity Esmeralda County produced $8,328,700 and Nye County $2,101,739.

Gold recovered from concentrates was valued at $1,754,429, or 11 per cent of the State product; crude ore shipped to smelters yielded $2,476,375 in gold, or 15 per cent. Slags and old tailings were the source of $205,954 in gold.

The production from different kinds of ore in 1909, with increase and decrease as compared with 1908, is shown in the following table:

Source of gold product in Nevada in 1909, by kinds of ore, by counties, in fine ounces.

County.	Placers.	Deep mines.					Grand total.
		Siliceous ore.	Copper ores.	Lead ores.	Copper-lead ores.	Total.	
Churchill		1,723.75				1,723.75	1,723.75
Clark		16,584.83		[a] 9.58		16,594.41	16,594.41
Douglas and Ormsby	10.35	25.35				25.35	35.70
Elko	150.74	5,945.33	1.02	25.98		5,972.33	6,123.07
Esmeralda	33.52	508,703.52		258.03		508,961.55	508,995.07
Eureka	718.66	7,151.47	.19	13,156.94		20,308.60	21,027.26
Humboldt	16.69	18,371.62		33.33		18,404.95	18,421.64
Lander		1,876.85		49.10	0.24	1,926.19	1,926.19
Lincoln		15,091.26		1,022.69	13.50	16,127.45	16,127.45
Lyon	9.14	5,268.09				5,268.09	5,277.23
Nye	2,944.88	138,983.75		581.32		139,565.07	142,509.95
Storey		26,926.54				26,926.54	26,926.54
Washoe		1,368.48				1,368.48	1,368.48
White Pine	129.45	412.06	17,688.12	321.84		18,422.02	18,551.47
Total	4,013.43	748,432.90	17,689.33	15,458.81	13.74	781,594.78	785,608.21
Increase (+) or decrease (−)	+155.47	+214,382.09	+13,059.75	+8,329.46	−.83	+235,770.47	+235,925.94

[a] Includes 2.66 ounces won from lead-zinc ores.

SILVER.

Nevada mines produced 10,981,061 fine ounces of silver, valued at $5,710,152 in 1909. This was an increase in quantity of 1,472,597 fine ounces, and of $670,666 in value. Nye County continued to be the largest producer and yielded 8,246,496 fine ounces, or three-fourths of the State's product. Of this quantity 7,872,967 fine ounces was won from the siliceous ores of Tonopah. Esmeralda County ranked second as a silver producer with an output of 1,299,090 fine ounces, and Storey County was third with a total of 501,625 fine ounces.

Eighty-six per cent of the silver yield, or 9,456,840 fine ounces, was mined in siliceous ores. This was an increase of 503,186 fine ounces, and resulted largely from an increased tonnage of silver-bearing siliceous ores from Nye County. Lead ores were the source of 1,415,416 fine ounces, or 13 per cent of the total product. The increase of 933,398 fine ounces from this class of ore resulted from larger shipments of argentiferous lead ores from Eureka and from Lucky Boy district, Esmeralda County, in 1909. Copper ores yielded 74,618 fine ounces, or more than twice as much as in 1908, from the increased tonnage of copper ore mined at Ely.

Nearly six-tenths of the silver yield, or 6,479,546 fine ounces, were recovered as bullion in gold and silver mills, and an additional tenth, or 1,097,467 fine ounces, was won from concentrates. Crude ore shipped to smelters carried 3,359,865 fine ounces, or three-tenths of the total output. Re-treatment of old tailings and slags yielded 42,648 fine ounces, and placer mines were the source of 1,534 fine ounces. The average recoveries per ton were 6.2 ounces in mill bullion, 18.6 ounces from smelter ores, and 0.65 ounce from slags and tailings. The crude ore sent to concentrating mills carried 0.19 ounce of silver per ton and the concentrates yielded 1.6 ounces per ton.

The source of silver product, by kinds of ore, with increase and decrease, is shown in the following table:

Source of silver product in Nevada in 1909, by kinds of ore, by counties, in fine ounces.

County.	Placers.	Deep mines.						Grand total.
		Siliceous ore.	Copper ores.	Lead ores.	Copper-lead ores.	Lead-zinc ores.	Total.	
Churchill		137,333		2,871			140,204	140,204
Clark		16,955		1,266		17,073	35,294	35,294
Douglas and Ormsby	2	2	38				40	42
Elko	79	57,834	1,004	19,554	1,098		79,490	79,569
Esmeralda	15	238,621	508	1,059,946			1,299,075	1,299,090
Eureka	85	23,715	1,285	162,183	442		187,625	187,710
Humboldt	2	74,708	214	5,715			80,637	80,639
Lander		59,221		1,089	1,211		61,521	61,521
Lincoln		113,612		98,411	12,829		224,852	224,852
Lyon	5	12,883					12,883	12,888
Nye	1,315	8,200,285	92	44,804			8,245,181	8,246,496
Storey		501,625					501,625	501,625
Washoe		806					806	806
Whitepine	31	19,240	71,477	19,577			110,294	110,325
Total	1,534	9,456,840	74,618	1,415,416	15,580	17,073	10,979,527	10,981,061
Increase (+) or decrease (−)	−479	+503,186	+45,297	+933,398	−25,878	+17,073	+1,473,076	+1,472,597

COPPER.

The mine production of copper in Nevada in 1909 was 57,976,477 pounds, valued, at the average price for the year of 13 cents per pound, at $7,536,942, as compared with 15,598,788 pounds, valued at $2,059,040, in 1908. This was an increase in quantity of 42,377,689 pounds, and in value of $5,477,902. By this very large increase copper is placed second in importance to gold as a mineral resource in Nevada, and Whitepine County is placed second in rank to Esmeralda County in the total value of metal output.

All but four counties made some production of copper, but the Ely district in Whitepine County furnished more than 99 per cent of the State yield. A copper output was made in 67 mines in 31 districts during 1909. It was the chief product of 15 mines and with gold formed the principal values of 2 more mines.

Crude smelting ore was the source of 3,014,655 pounds, and 53,622 pounds were recovered from concentrates derived from ores treated at gold and silver mills, but the bulk of the yield, or 54,908,200 pounds, was mined in the 1,684,103 tons of crude ore sent to concentrating mills. This class of ore yielded in recovered concentrates 32.6 pounds of copper to the crude ton, and the resultant 198,453 tons of concentrates contained 276.7 pounds of copper per ton.

LEAD.

The mine output of lead in Nevada in 1909 was 9,840,791 pounds, valued, at the average price for the year of 4.3 cents, at $423,154, as compared with a production of 7,245,619 pounds, valued at $304,316, in 1908. The increase in quantity was 2,595,172 pounds, or 36 per cent.

Twelve of the 15 metal producing counties made a lead yield in 1909. Eureka County was first with 4,346,535 pounds, followed by Esmeralda County with 1,691,884 pounds, Lincoln County with 1,495,628 pounds, and White Pine County with 1,043,629 pounds. Notably increased productions were made in Esmeralda, Eureka, Elko, and Lincoln counties, while Clark, Lander, Nye, and White Pine counties shipped much smaller quantities than in 1908.

Some lead was produced at 114 mines in 43 districts in Nevada in 1909, and this metal was the chief product of 25 mines. At 23 mines, silver and lead, at 3 mines, gold, silver, and lead, and at 2 mines, gold and lead formed the principal values.

Crude smelting ore was the source of 9,777,418 pounds, or over 99 per cent of the total output. Crude ore sent to concentrating mills yielded in concentrates 50,930 pounds, and 12,443 pounds were marketed in concentrates produced from ore sent to gold and silver mills.

ZINC.

The zinc output for 1909 almost trebled the production of 1908. Reduced to terms of spelter and figured at the average price of spelter for the year, 5.4 cents per pound, the yield was 3,013,352 pounds, valued at $162,721. This was an increase in quantity of 1,897,501 pounds and in value of $110,276.

The entire production was mined in Yellowpine district, Clark County, zinc shipments being reported from 7 mines, 2 of which produced zinc-lead ore. The ore was sorted and shipped without further concentration to Colorado and Kansas smelters.

Number of mines, classified by chief product, in Nevada in 1909, by counties.

County.	Gold placer mines.				Deep mines.											Total mines reporting product.
	Hydraulic.	Drift.	Dry washing and sluicing.	Total.	Gold.	Silver.	Copper.	Lead.	Zinc.	Gold and silver.	Gold-silver-lead.	Gold and copper.	Gold and lead.	Silver-lead.	Total.	
Churchill					3	3				1				1	8	8
Clark					11	1		2	[a] 7	1					22	22
Douglas and Ormsby			1	1	1							1			2	3
Elko	1		2	3	13	3	3	4		3				4	30	33
Esmeralda		2	1	3	48	15	2	2		8	1			2	78	81
Eureka			6	6	7	4	2	3		4			1	2	23	29
Humboldt			2	2	28	7	1			3				7	46	48
Lander					9	4				1	1			2	17	17
Lincoln					7	1		5						4	17	17
Lyon			1	1	18							1			19	20
Nye	1	11	8	20	39	11	1	2		5	1				59	79
Storey					16	1				5					22	22
Washoe					11										11	11
White Pine		2	3	5	3	3	6	7		1			1	1	22	27
Total	2	15	24	41	214	53	15	25	7	32	3	2	2	23	376	417

[a] Includes 2 lead-zinc mines.

Mine production of gold, silver, copper, lead, and zinc in Nevada in 1909 by counties.

County.	Gold.		Silver.		Copper.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Fine ozs.		*Fine ozs.*		*Pounds.*	
Churchill	1,723.74	$35,633	140,204	$72,906		
Clark	16,594.41	343,037	35,294	18,353	23,308	$3,030
Douglas and Ormsby	35.70	738	42	22	2,500	325
Elko	6,123.07	126,575	79,569	41,376	46,531	6,049
Esmeralda	508,995.07	10,521,862	1,299,090	675,527	96,907	12,598
Eureka	21,027.26	434,672	187,710	97,609	101,500	13,195
Humboldt	18,421.64	380,809	80,639	41,932	5,477	712
Lander	1,926.19	39,818	61,521	31,991	4,939	642
Lincoln	16,127.45	333,384	224,852	116,923	173,446	22,548
Lyon	5,277.23	109,090	12,888	6,702	462	60
Nye	142,509.95	2,945,942	8,246,496	4,288,178	13,261	1,724
Storey	26,926.54	556,621	501,625	260,845		
Washoe	1,368.48	28,289	806	419		
White Pine	18,551.47	383,493	110,325	57,369	57,508,146	7,476,059
Total	785,608.21	16,239,963	10,981,061	5,710,152	57,976,477	7,536,942

County.	Lead.		Zinc.		Total value.
	Quantity.	Value.	Quantity.	Value.	
	Pounds.		*Pounds.*		
Churchill	26,602	$1,144			$109,683
Clark	445,907	19,174	3,013,352	$162,721	546,315
Douglas and Ormsby					1,085
Elko	576,768	24,801			198,801
Esmeralda	1,691,884	72,751			11,282,738
Eureka	4,346,535	186,901			732,377
Humboldt	60,488	2,601			426,054
Lander	53,116	2,284			74,735
Lincoln	1,495,628	64,312			537,167
Lyon	2,698	116			115,968
Nye	95,675	4,114			7,239,958
Storey	1,861	80			817,546
Washoe					28,708
Whitepine	1,043,629	44,876			7,961,797
Total	9,840,791	423,154	3,013,352	162,721	30,072,932

MINING INDUSTRY IN NEVADA IN 1909.

As shown in the foregoing tables, the year 1909 was a period of great progress in Nevada. With approximately the same number of producing mines, a much larger tonnage of ore was handled and there was an increase in the yield of each of the five metals under review. The large metal production in 1909 and the big increase in yield did not represent the boom phase of mining which the public often associates with Nevada, but they did represent the result in part of several years of mine development, mill building, and other preparatory work at the larger mines of the State.

Thus the gold output was principally due to the operation of the Goldfield Consolidated Mines Company's new mill throughout the year, and to a less degree to increased milling facilities in other camps which had been in the course of development.

Likewise the copper yield resulted from the beginning of mining, milling, and smelting on a large scale in the Robinson district, Whitepine County, after years of preparatory work. The production for 1909 though large was far from being a capacity yield and will be exceeded with further development.

The silver yield represented an increased recovery from several well-established camps; principally from Tonopah and, to a less extent, from the new Lucky Boy district. The old mines at Eureka furnished the bulk of the lead yield. The developing and mining of large quantities of high-grade zinc ores in the Yellowpine district in 1909 promises for Nevada a steady production and probably an increasing yield of zinc.

Of the new camps of 1909 the National, in Humboldt County, was the most important, and promises to become one of the most important gold producers of the State. Other new camps include Jarbidge, in Elko County, and Bannock and Hill Top, in Lander County. A substantial initial yield was made from the Hill Top mines.

During 1909 many new and important strikes were made in the large mines at Goldfield and Tonopah, and the discovery and rapid development of placer gravels at Manhattan afforded that district a temporary revival. As far as new work was concerned, 1909 was relatively a quiet year in Nevada as it was in other mining States in the West.

The large total production in 1909 represented the maximum yield in no district, but indicated a steadily increased capacity, and in most districts further increase was expected in the output for 1910. A notable exception is the permanent closing of the old Bamberger-Delamar mines in Lincoln County in 1909, which will cause a heavy decrease in the gold yield from Lincoln County.

The Western Pacific Railroad was completed across the northern tier of counties in Nevada, and the section west of Winnemucca in Humboldt and Washoe counties will afford improved shipping facilities, but east of Winnemucca the new road lies parallel to the Southern Pacific as far as Wells, in Elko County.

The Nevada Copper Belt Railroad was being constructed to serve the Mason Valley section in Lyon County, where numerous copper deposits are being developed, including the mines at Yerington.

The mines of the State were remarkably free from labor troubles of any kind, except at Ely, where the Cumberland Ely mine was idle for six months because of a strike.

REVIEW BY COUNTIES.

CHURCHILL COUNTY.

Eight mines in Churchill County in 1909 produced 1,211 tons of ore, which yielded 1,723.75 fine ounces of gold, valued at $35,633, 140,204 fine ounces of silver, valued at $72,906, and 26,602 pounds of lead, valued at $1,144, or a total value of $109,683. Sixteen mines in 1908 produced 2,090 tons of ore, which yielded $54,920 in gold, 265,425 fine ounces of silver, 5,212 pounds of copper, and 1,690 pounds of lead, with a combined value of $196,354. Thus there was a decrease in 1909 of $19,287 in gold, 125,221 fine ounces of silver, 5,212 pounds of copper, and an increase of 24,912 pounds of lead, resulting in a net decrease in total value of $86,671, or over 44 per cent. In 1907 this county produced more than five times as much as in 1909.

As in 1908, the entire gold output and almost the entire silver yield were won from the siliceous ores, of which there were 1,173 tons. Only 2,871 ounces of silver were produced from 38 tons of lead ore.

The entire tonnage was shipped to smelters and averaged in value $90.57 per ton, as compared with an average value of $93.95 per ton in 1908. Only the higher grade ores could be marketed from most of the districts of this county because of the cost of long wagon hauls.

The mines in the Boyer district and in the Eagleville or Hot Springs district were idle in 1909, and only assessment work was reported from the Eastgate district.

Fairview district.—Five producing mines in this district yielded 1,204 tons of ore, containing 1,706.53 fine ounces of gold, valued at $35,277; 139,858 ounces of silver, valued at $72,726; and 26,602 pounds of lead, valued at $1,144, or practically the entire metal production of the county for 1909; yet the output was but three-quarters as much as the district produced in 1908.

The Nevada Hills mines, the largest in the county, made a greatly reduced yield. The ore averaged in value about $2 in silver to $1 in gold. Transportation was by wagon 42 miles to the railroad at Fallon, and thence by rail to Salt Lake City smelters. The mine is opened by a 1,200-foot shaft and a 1,500-foot tunnel.

The Fairview Eagle Mining Company increased its shipments fourfold in 1909. Some silver ore was shipped from the Nevada Fairview mine. Silver-lead ore was shipped from the New Year's group, on Chalk Mountain.

Jessup district.—Jessup district lies near the Humboldt County line, about 10 miles north of Huxley, a station on the Southern Pacific Railroad. The Stewart Mining Company made a small shipment of gold ore and did about 300 feet of development work.

Whitecloud district.—This district, including the mines at Coppereid, 35 miles southeast of Lovelocks, and those 25 miles southeast from Lovelocks, which were being developed, made no production in 1909.

Whiteplains district.—Just south of the Jessup district, near Whiteplains, the Desert Queen mines were actively worked prior to 1885, but since then only prospect and development work has been carried on, with occasional small shipments.

Wonder district.—Most of the mines and prospects of Wonder district were idle during 1909, development work only being done.

CLARK COUNTY.

Mine production of metals and their ores in Clark County, Nev., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold.....fine ounces..	13,553.03	$280,166	16,594.41	$343,037	+3,041.38	+$62,871
Silver.....do...	21,213	11,243	35,294	18,353	+ 14,081	+ 7,110
Copper.....pounds..	62,719	8,279	23,308	3,030	− 39,411	− 5,249
Lead.....do....	765,142	32,136	445,907	19,174	− 319,235	− 12,962
Zinc.....do....	1,115,851	52,445	3,013,352	162,721	+1,897,501	+110,276
Total.....	....	384,269	....	546,315	....	+162,046
Ore output.....short tons..	56,914	[a] 6.75	77,648	[a] 7.04	+ 20,734	+ [a] .29

[a] Value per ton.

The yield of 22 producing mines in Clark County in 1909 showed substantially increased returns for gold, silver, and zinc, and corresponding large decreases in copper and lead production. There were

77,648 tons of ore treated, an increase of 20,734 tons, or 36 per cent, and the total value was larger by $162,046, or 42 per cent.

As in 1908 nearly all of the gold and almost one-half of the silver was won from the siliceous ores, of which there were 72,959 tons treated, an increase of 18,741 tons. Copper ores decreased 202 tons, none being reported in 1909, and lead ores fell off 653 tons, as only 48 tons were so classified. This apparent decrease was more than offset by a production of 1,759 tons of lead-zinc ores, which yielded 17,073 fine ounces, or more than half of the silver product of the county. Zinc ore shipments were increased from 1,793 tons to 2,882 tons. Classified by chief products, there were 11 gold, 1 silver, 1 gold and silver, 2 lead, 5 zinc, and 2 lead-zinc mines.

There were 34,212 tons of ore sent to gold and silver mills, and the bullion yield was valued at $199,817 in gold and $1,897 in silver, or an average recovery of $5.90 per ton. In 1908 the mill ore amounted to 28,724 tons, and yielded $7.60 per ton in value of gold and silver. Smelters received 5,151 tons of ore from this county in 1909, carrying $20,700 in gold, 23,031 fine ounces of silver, 23,308 pounds of copper, 445,907 pounds of lead, and 3,013,352 pounds of zinc, which yielded a total value of $217,627 and averaged $42.25 per ton. Over 75 per cent of this total value, or $162,721, was the zinc yield. In 1908 there were 3,000 tons of crude ore shipped to smelters carrying $110,297 in metal values, an average of $36.77 per ton. The re-treatment of 38,285 tons of old tailings in 1909 yielded $122,365 in gold and 8,560 fine ounces of silver, or an average recovery of $3.31 per ton.

The efforts to work the placer gravels along Colorado River by means of dredges did not prove successful in 1909.

Bunkerville district.—Operations in the Bunkerville or Copper King district were restricted to development work on the Great Eastern group.

Crescent district.—From the "4 C's" group of mines a small shipment of gold and silver bearing lead ore was made to a smelter at Salt Lake City.

El Dorado Canyon district.—From 3 mines in this district smelter shipments were made in 1909. There was a small lead production in addition to the increased yield of gold and silver. The Santa Barbara Searchlight Mining Company built a lead smelter with a capacity of 125 tons per day. This company operated the Santa Barbara mine in the Searchlight district and the Rich Hill mine in the El Dorado district. Some ore was shipped to the smelter at Needles from the Success mines and from the Capital group.

Gold Butte district.—There was little mining activity beyond development in this district about St. Thomas in 1909.

Las Vegas district.—There were no producing mines in Las Vegas section in 1909.

Searchlight district.—Eight mines in this district produced 68,931 tons of ore, which yielded $335,645 in gold, 13,544 fine ounces of silver, 22,916 pounds of copper, and 36,209 pounds of lead, with a total value of $347,224. There was a large increase in the tonnage and in the yield of gold, silver, and copper, but a decrease in the lead output. The total value, $347,224, was an increase of $66,025, or 23 per cent. Mill ore yielded $199,817 in gold and $1,897 in silver from 34,212 tons of ore in 1909. The smelters received 434 tons of crude ore, carrying

$18,993 in gold and 2,331 fine ounces of silver, in addition to all the copper and lead. By re-treating 34,285 tons of slags and old tailings $116,680 in gold and 7,560 fine ounces of silver were recovered.

The Quartette mines, the largest producer in Clark County, made an increased output; 4,518 feet of development work was done in the mines in 1909. The main incline shaft was 1,200 feet deep. The property is equipped with a 20-stamp mill, with an amalgamating capacity of 65 tons per day and a 150-ton cyanide plant.

From the Good Hope and Duplex groups there was a yield equal to that of 1908. Lessees on the Chief of the Hills mine sent ore to a custom mill in 1909. The 10-stamp mill of the Pompeii mine was operated during the summer months. Operators at the Peerless group milled some crude ore and re-treated old tailings in 1909 in a 10-stamp amalgamation and cyanide mill.

From the Searchlight-Spokane mines a small shipment of gold ore was sent to the smelter at Needles.

Yellowpine district.—From 10 producing mines in Yellowpine district 4,664 tons of ore were shipped to smelters and 4,000 tons of old tailings were treated in 1909. The metal yield from the 8,664 tons was $5,740 in gold, 18,461 fine ounces of silver, 392 pounds of copper, 406,353 pounds of lead, and the entire zinc output of the State, 3,013,352 pounds, valued at $162,721—a total value of $195,585. The gold, copper, and lead yields were very much smaller than in 1909, but the large increase in the value of the zinc product, together with an increased silver output, almost doubled the total value from the district.

The Yellowpine district includes a considerable area of sparsely settled territory in Clark County, southwest of Las Vegas, extending to the California line and embracing the towns of Goodsprings, Sandy, Jean, Arden, and Roach. The last three towns are shipping stations on the railroad. The district has produced silver-lead ores for many years, but only in the last few years has ore been marketed for the zinc content. Thus far zinc shipments have been restricted to oxidized ores, and by hand sorting the zinc content has been kept up to an average of about 45 per cent. The ore is said to occur "as a replacement in limestone, not in a well-defined vein, but in an easily determined zone."[a] The ores are classified as lead-silver ores, zinc ores, and mixed lead silver-zinc ores, in which the lead carries the silver values. The zinc ores are shipped to Colorado and Kansas points for smelting; the lead ores are smelted in Utah plants.

The Monte Cristo Consolidated mines, 7 miles southwest of Jean, were the largest producers of the district. An increased tonnage of high-grade zinc ore was mined by means of glory holes and shipped to Kansas and Oklahoma smelters. The Yellowpine Mining Company shipped silver-bearing lead ores to Salt Lake smelters and zinc ores to Colorado and Oklahoma points. The property is 12 miles from Jean. A trial shipment of lead ore was made from the Pilgrim mine. Shipments of zinc ore were also made in 1909 from the Frederickson mine, 8 miles, and from the Green Mountain mine, 12 miles west of Jean.

The Ingomar mine, 14 miles northwest of Roach, produced some high-grade zinc ore and some silver-bearing lead ore from shallow workings in 1909, and zinc ore was also shipped from the "Goodsprings" mine, 12 miles from Goodsprings. A reduced production was made from the Old Potosi mine, 20 miles west of Arden, the lead ore being sent to Salt Lake and the zinc product to Denver. This mine, which has been worked for silver and lead since 1860, was idle most of 1909.

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[a] Gregory, N. B., Eng. and Min. Jour., Dec. 31, 1910, p. 1308.

DOUGLAS COUNTY.

Only one small lode mine produced in Douglas County in 1909, and the placer yield was considerably smaller than in 1908. In 1908 the output from 3 placer mines and 2 lode mines was $3,345 in gold and 32 fine ounces of silver.

Development work was carried on in the Gardnerville district and in the Wellington section.

ELKO COUNTY.

Mine production of metals and their ores in Elko County, Nev., 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold..................fine ounces..	8,921.27	$184,419	6,123.07	$126,575	−2,798.20	−$57,844
Silver..........................do....	47,480	25,164	79,569	41,376	+ 32,089	+ 16,212
Copper....................pounds..	130,197	17,186	46,531	6,049	− 83,666	− 11,137
Lead.........................do....	478,881	20,113	576,768	24,801	+ 97,887	+ 4,688
Total....................................	....	246,882	....	198,801	....	− 48,081
Ore output..............short tons..	26,438	[a] 9.30	12,194	[a] 16.04	− 14,244	+ [a] 6.74

[a] Value per ton, placer gold excluded.

The total value of the output of the mines of Elko County in 1909 was $198,801, or four-fifths as much as in 1908. Large decreases were made in the gold and copper production, but the silver and lead returns increased as they did the year before, yet the gold values still comprise nearly seven-tenths of the total values.

The decrease of $57,844 in gold was caused by the temporary idleness of the Lucky Girl mine in the Centennial district, pending the settlement of a suit. Nearly the entire gold output of the county is won from siliceous ore.

The silver production increased 32,089 fine ounces. Of the total yield, 57,834 fine ounces, or 73 per cent, was from siliceous ore, 19,554 fine ounces, or 25 per cent, was from lead ores, and the remainder was from copper and copper-lead ores and placer clean-ups.

The decrease of 83,666 pounds, or 64 per cent, in the output of copper from Elko County was caused by greatly reduced shipments from Contact, Dolly Varden, Tuscarora, Railroad, and Tecoma districts; the first three districts made no copper output in 1909. The production from Spruce Mountain district increased fourfold. The lead yield increased 97,887 pounds, principally because of the operation of the smelter in Spruce Mountain district. Increased productions were also reported from Dolly Varden and Tecoma districts; the Ruby Valley and Railroad districts made decreased lead outputs.

There were 12,194 tons of ore treated in Elko County in 1909, less than half as much as in 1908, but the grade of ore increased in value from $9.30 per ton to $16.04 because of the reduced tonnage of mill ore handled in the Centennial district.

Of the 12,194 tons of ore mined in the county, 10,721 tons or 88 per cent were siliceous, 1,243 tons were lead ores, 150 tons were copper ores, and 80 tons were copper-lead ores. There were 2,971 tons of ore milled in 1909 as against 20,167 tons in 1908, but the yield of $68,313 in gold and 4,194 fine ounces of silver, represented an average bullion recovery of $23.73 per ton as against $7.56 per ton in 1908. The difference was caused by the milling of a reduced tonnage of low-grade ore in the northern districts and of increased tonnage of comparatively high-grade rock in the Gold Circle district. Concentrates from the mill ore carried $5,816 in gold, 40,944 fine ounces of silver, and small quantities of copper and lead.

There was also a small quantity of ore sent to concentrating mills in this county. The 1,531 tons of crude ore shipped to smelters carried $26,489 in gold, 22,952 fine ounces of silver, 45,816 pounds of copper, and 573,000 pounds of lead, with an aggregate value of $69,019 and an average value of $45.15 per ton. In 1908 the yield from 1,771 tons of smelting ore averaged $37.33 per ton. There were 3 placer and 30 deep mines operating in 8 districts in 1909. Classified by the chief products the deep mines included, 13 gold, 3 silver, 3 copper, 4 lead, 3 gold and silver, and 4 silver-lead mines. In 1908 3 placers and 29 deep mines reported a production from 12 districts. W. H. Emmons visited the camps in the western half of Elko County in the summer of 1908, and in Bulletin 408 of the United States Geological Survey he has given descriptive notes on the following camps: Aura, Bullion (Railroad district), Burner, Columbia, Cornucopia, Edgemont, Falcon, Gold Circle, Good Hope, Lime Mountain, Lone Mountain, Mountain City, Tuscarora, and Vanduser Creek.

In the following notes on the districts of the county, frequent quotations have been made from his report.

Aura district.—The production from the mines of Aura district was only one-fifth as large as in 1908.

Cobre section.—Development work only was reported in this section in 1909.

Contact district.—There was no production from Contact district in 1909, but development work was carried on at several mines.

Centennial district.—There was a greatly reduced yield from the mines at Edgemont on the west slope of Centennial Range. The Montana Mining Company, the largest producer in the county in 1908, was involved in a lawsuit and the mill was temporarily shut down. The Lucky Girl group of this company was developed by nearly 5 miles of underground work and 2,700 feet of work was done in 1909. "The ore deposits are fissure veins in siliceous sedimentary rocks which are steeply tilted, folded, and faulted. The prevailing country rock is a brown or gray quartzite of rather uniform grain. The ore is highly siliceous and carries more than 90 per cent of quartz." [a] The sulphides are pyrite, galena, and arsenopyrite. The gold content averages $5 to $10 per ton and is associated with the sulphides or with their oxidation products.

Dolly Varden district.—Two mines produced silver-lead ores with small gold values in the Dolly Varden district in 1908.

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[a] Emmons, W. H., Bull. U. S. Geol. Survey No. 408, 1910, p. 50; see also pp. 75–79.

Gold Creek district.—A small placer cleanup was made in the Gold Creek district in 1909.

Gold Circle district.—The mine production of this district in 1909 was 1,815 tons of ore which yielded $88,635 in gold and 3,717 fine ounces of silver, with a total value of $90,568. This district began producing in 1908 with a yield of 245 tons of ore, which contained $36,561 in gold, and 1,172 fine ounces of silver, having a total value of $37,182 and an average yield per ton of $151.76. With the completion of local mills less high-grade ore was hauled to railroads and shipped to smelters in 1909 and increased quantities of lower-grade ore were milled so that the average recovered value per ton dropped to $49.90, and the value of the ore sent to mills averaged $36.44 per ton.

In this district, according to W. H. Emmons:

> The deposits in the main are replacement veins in sheeted zones in rhyolite, which are located along prominent slickensided planes of movement. All the fissures strike northwestward and are with few exceptions approximately parallel. In general they dip from 65° to 85° NE. In the commonest type a few inches of high-grade iron-stained siliceous ore occurs here and there along the slip planes, and in places the surrounding country rock for a distance of several feet is shattered and seamed with veinlets of quartz carrying gold. Thin drusy cavities with well-formed crystals of colorless quartz are found locally in these veinlets, and at some places this quartz is banded with a black silver-rich mineral, probably argentite. The rhyolite near the vein is devitrified, silicified, stained with iron oxide, and at many localities replaced by ore. * * * The gold is almost without exception associated with pyrite, with iron oxide, or with quartz highly stained with iron or manganese. At some places the sulphides begin to appear within a foot or two of the surface. The depth of the partly oxidized zone is from 100 to 150 feet below the surface.[a]

The largest producing mine in the district was the Esmeralda, most of whose output was milled by the American Ore Reduction Company. At the Gold Circle claim "a zone of crushed silicified and highly iron-stained rhyolite along a fault between andesite and rhyolite pans free gold liberally."[b]

At the Queen mine, the second producer in the district, some ore was reduced in the company's own 4-ton muller mill and some smelter shipments were made.

Jarbidge district.—Jarbidge is the name given to a new district in the northern part of Elko County. The district lies east of north of Charleston and east of Rowland in the rugged country at the headwaters of Jarbidge River. The first announcement of the new discovery was made in October, 1909, and the usual rush followed, but the ground was covered with snow and little prospect work was attempted until the following spring. The elevation at Jarbidge camp is about 6,400 feet, but the prospects are in some cases much higher as the area is extremely precipitous. Development work has been retarded by the lack of transportation facilities, as supplies must be freighted in from Twin Falls, Idaho, 90 miles distant over a rough country and at a prohibitive cost. It is planned to build 17 miles of new road to Charleston, and thus afford a 65-mile haul to the main lines of the Southern Pacific Company and the Western Pacific Railway Company at Deeth.

Railroad district.—The mines of Railroad district, at Bullion, 12 miles southeast of Palisade, supplied to smelters a small tonnage of ore and concentrates, which yielded $833 in gold, 2,061 fine ounces of silver, 5,116 pounds of copper, and 38,535 pounds of lead, with a total value of $4,227. In 1908, from this district, 649 tons of ore yielded a total value of $18,298. The mines of this section were first worked in the seventies and eighties, when the ore was reduced in two small local smelters. In 1906 the mines were reopened, and development work has resulted in ore shipments to Salt Lake smelters. Most of the production of the district has been from ore occurring as replacement deposits of lead, silver, and copper ore in marbleized limestone.

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[a] Emmons, W. H., Bull. U. S. Geol. Survey No. 408, 1910, pp. 50-52.

[b] Op. cit., p. 57.

The Nevada Bunker Hill Mining Company made reduced shipments of copper-lead ores carrying small silver values. At the Elk mine of this company the ore bodies are irregular replacement veins in limestone, which intersect to form chimneys of ore. "Nearly everywhere the ore is highly oxidized. The principal ore minerals are lead and copper carbonates, copper and iron oxides, bornite, pyrite, chalcopyrite, and a copper-antimony sulphide which is probably gray copper. Quartz and calcite are the important gangue minerals; * * * "[a]

At the Sweepstake mine of the Delmas Copper Company, the silver-lead ore carried small gold and copper values, principally in sulphide minerals. Development work was done at several mines in the district.

Spruce Mountain district.—With 4 producing mines in Spruce Mountain district, 45 miles south of Wells (as compared with 1 producer in 1908), the production was increased materially. The yield from 750 tons of ore smelted, including 600 tons of lead ore and 150 tons of copper ore, was $115 in gold, 10,668 fine ounces of silver, 40,615 pounds of copper, and 201,861 pounds of lead, with a total value of $19,622. Ore from the Black Forest mines, the district's largest producer in 1909, was reduced in a 30-ton lead blast furnace on the property. The mine is opened by 8,000 feet of tunnel work. From the Spruce Mountain copper mines silver-bearing copper ore was shipped to Utah smelters.

Tecoma district.—The yield from the Tecoma district was a little larger than in 1908 and consisted of 532 tons of lead ores, bearing $169 in gold, 5,469 fine ounces of silver, 85 pounds of copper, and 314,861 pounds of lead, with a total value of $16,563. The principal producer, the Jackson mines, were developed by 200 feet of work.

Tuscarora district.—The yield from cyaniding old tailings in this district was about equal to the recoveries in 1908. Hydraulic operations by the Nevada Hydraulic Mining and Milling Company resulted in a placer clean up in this district in 1909. Placer deposits were first discovered in this section in 1867, and the total placer yield to date from the district is reported to have been $7,000,000.

ESMERALDA COUNTY.

Mine production of metals and their ores in Esmeralda County, Nev., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity	Value.	Quantity	Value.
Gold............fine ounces..	289,527.76	$5,985,070	508,995.07	$10,521,862	+219,467.31	+$4,536,792
Silver..................do....	438,588	232,452	1,299,090	675,527	+ 860,502	+ 443,075
Copper..............pounds..	32,500	4,290	96,907	12,598	+ 64,407	+ 8,308
Lead....................do....	590,119	24,785	1,691,884	72,751	+ 1,101,765	+ 47,966
Total..............................	....	6,246,597	....	11,282,738	....	+ 5,036,141
Ore output......short tons..	208,421	[b] 29.97	468,703	[b] 24.07	+ 260,282	− [b] 5.90

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[a] Op. cit., p. 93.

[b] Value per ton.

With a total metallic yield valued at $11,282,738, of which $10,521,862, or over 94 per cent, was in gold, Esmeralda County ranked first among the counties of Nevada in 1909 as a source of gold and in total value of combined production.

Large increases were made in the yield of all four metals, the gold figures almost doubled, the silver and copper figures almost trebled, and the lead product more than doubled the figures of production for 1908.

The gold increase of $4,536,792, or 76 per cent, resulted from the large increase made in the Goldfield district, and from increases in Rawhide, Silver Peak, and Hornsilver districts. With the exception of 3 other small districts, the remaining 11 districts in Esmeralda County made decreased gold yields. Likewise, most of the districts of the county made a reduced silver yield in 1909, but the large increased production of silver from lead ores in Lucky Boy district and to a less degree from siliceous ores in Rawhide district resulted in an increase of 860,502 fine ounces in the county output. The Lucky Boy district also furnished the increased lead production of 1909. Esmeralda County ranked second to Nye County in yield of silver and second to Eureka County in the production of lead.

Seventy-eight lode mines, operating in 16 districts, produced 468,703 tons of ore with a total average recovery of $24.07 per ton, as compared with an average yield of $29.97 per ton from 208,421 tons of ore, from 76 mines, operating in 22 counties in Esmeralda County in 1908. Classified by the chief products there were 48 gold, 15 silver, 8 gold and silver, 2 copper, 2 lead, 2 silver-lead, and 1 gold-silver-lead mines.

The ore production included 460,116 tons of dry or siliceous ores, 8,432 tons of lead ores, and 155 tons of copper ores. The siliceous ores increased 253,181 tons and were the source of nearly all of the gold, and 238,621 fine ounces, or over 18 per cent, of the silver. The lead ores increased 7,042 tons, or fivefold, and yielded $5,334 in gold and 1,059,946 fine ounces, or nearly 72 per cent, of the silver yield of the county.

The copper ores contained 508 fine ounces of silver, but no gold.

From 437,145 tons of ore sent to gold and silver mills, $8,328,700 in gold and $38,718 in silver was recovered as bullion, an average yield of $19.14 per ton. From this ore 11,125 tons of concentrates were produced which yielded $957,941 in gold, 6,577 fine ounces of silver, and 52,015 pounds of copper, or an average recovery valued at $87.02 per ton in all metals. Thus the 437,145 tons of mill ore yielded as bullion, and in concentrates a total value of $9,335,541 in all metals, or an average value of $21.36 per ton. Only a small quantity of ore was sent to concentrating mills in 1909. There were 29,260 tons of ore shipped to smelters, with a metal content of $1,185,966 in gold, 1,209,450 fine ounces of silver, 44,892 pounds of copper, and 1,691,884 pounds of lead, altogether valued at $1,893,467, which represented an average value of $62.03 per ton in gold and silver and $64.71 per ton in all metals. The re-treatment of 2,287 tons of slag and old tailings yielded $44,809 in gold and $1,347 in silver.

Aurora district.—As in the two preceding years, the Cain Consolidated Mining Company was the only producer in the Aurora district, and this company reported a decreased output from mine and mill. This old district, a prominent producer in the "sixties," has been overlooked in the last few years when so many new camps have been established, and other old camps revived, but the early advent of electric power in this section seems to promise renewed activity.

Buena Vista district.—The mines in Buena Vista or Oneota district made no output in 1909.

Goldfield district.—The following table shows the production of metals and ores in the Goldfield district in 1908 and 1909:

Mine production of metals and their ores in Goldfield district, Nev., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold............fine ounces..	236,082.14	$4,880,251	453,915.25	$9,383,261	+217,833.11	+$4,503,010
Silver...................do....	30,823	16,336	33,164	17,245	+ 2,341	+ 909
Copper..............pounds..	1,606	212	52,015	6.762	+ 50,409	+ 6,550
Total....................	....	4,896,799	....	9,407,268	....	+ 4,510,469
Ore output......short tons..	88,152	[a] 55.55	297,199	[a] 31.65	+ 209,047	− [a] 23.90

[a] Value per ton.

The gold production of Goldfield district was $9,383,261, or $4,503,010 more than in 1908, and constituted 58 per cent of the total gold yield of Nevada in 1909. This was a record output for the district, exceeding the yield of 1907 by $974,865. The silver and copper productions were both increased, but the values of these metals are of comparatively little importance in this district. Twenty-one mines, in 1909, produced 297,199 tons of ore, with an average value of $31.65 per ton, as compared with 88,152 tons, valued at $55.55 per ton in 1908. In 1909 the Goldfield Consolidated mines and the Goldfield Florence mines produced an increased tonnage of mill ore; in 1908 these companies shipped rich ore to the smelters to keep up the gross production while the new mills were being erected.

All of the ore of the district was siliceous. Bullion returns from 278,644 tons of ore sent to gold and silver mills showed a production of $7,307,635 in gold and $9,259 in silver, a total of $7,316,894 for both metals and an average recovery valued at $26.26 per ton. From this ore 11,112 tons of concentrates were produced, which yielded $956,249 in gold, 5,994 fine ounces of silver, and 52,015 pounds of copper, or a total recovered value of $966,128, and an average value of $86.94 per ton. Thus the ore sent to mills yielded a total recovery of $8,283,022, or an average yield of $29.73 per ton.

In 1908 the bullion recovery averaged $36.24 per ton and total recovery from mill ore averaged $36.79 per ton, but only 30,003 tons of ore were milled in the district in that year.

The 18,268 tons of crude ore shipped to smelters in 1909 carried $1,077,131 in gold and $3,705 in silver, or an average value of $59.17 per ton. An average yield of $65.30 per ton was recovered from the 58,025 tons shipped to smelters in 1908. The re-treatment of 287 tons of slags and cinders resulted in an additional recovery of $42,122 in gold and of $1,163 in silver.

Ore production in Goldfield district in 1907, 1908, and 1909, classified according to method of treatment, with increase and decrease for each year.

Year.	Ore to smelters.		Ore to mills.		Total.	
	Short tons.	Average value per ton.	Short tons.	Average value per ton.	Short tons.	Average value per ton.
1907	83,354	$91.86	17,782	$44.90	101,136	$83.61
1908	58,025	65.30	30,003	36.79	[a] 88,152	55.55
Increase (+) or decrease (−)	−25,329	− 26.56	+12,221	− 8.11	− 12,984	− 28.06
1908	58,025	65.30	30,003	36.79	[a] 88,152	55.55
1909	18,268	59.17	278,644	29.73	[b] 297,199	31.65
Increase (+) or decrease (−)	−39,757	− 6.13	+248,641	− 5.06	+209,047	− 23.90

[a] Includes 124 tons old tailings.

[b] Includes 287 tons slags and cinders.

This table furnishes a summary of the changes caused by the advent of milling operations in the district. In 1908, with comparatively small milling facilities, there was a decrease of 25,329 tons in the quantity of ore shipped to smelters and a decrease of $26.56 per ton in the grade of the ore; the increase of ore milled also resulted in the handling of a lower grade of ore.

Again, with the greatly increased mill capacity of 1909, a further lowering of the grade of both mill and smelter ores was brought about, resulting in the two years in a decrease of $51.96 per ton in the grade of ore treated in the district.

The following table shows production of gold and silver in the Goldfield district from the time it became productive up to the end of 1909:

Mine production of Goldfield district, Esmeralda County, Nev., from its inception in 1903 to 1909, inclusive, in fine ounces.

Year.	Gold.		Silver.		Total value.
	Quantity.	Value.	Quantity.	Value.	
1903	3,418.66	$70,670	287	$155	$70,825
1904	113,293,23	2,341,979	19,954	11,374	2,353,353
1905	91,087.76	1,882,951	8,589	5,188	1,888,139
1906	339,890.20	7,026,154	15,648	10,484	7,036,638
1907	406,756.16	8,408,396	71,710	47,329	8,455,725
1908	236,082.14	4,880,251	30,823	16,336	4,896,587
1909	453,915.25	9,383,261	33,164	17,245	9,400,506
Total	1,644,443.40	33,993,662	180,175	108,111	34,101,773

The increase in the milling facilities of the district, making it profitable to produce a very large tonnage of ore, previously held for cheaper means of reduction, represented the most important note of progress to record for the year 1909. Otherwise the year was probably the quietest in the history of the district, though it did produce the largest yield.

The Goldfield Consolidated mines, in 1909 the largest gold producer in the United States, started the new 100-stamp mill in the last week of 1908 and operated it continuously throughout 1909.

The company produced practically half of the State's total gold output in 1909. In the published annual report covering the fiscal year ending October 31, 1909, may be found the following interesting statements:

> The properties have produced 194,479.67 tons of ore, of an average value of $37.98 per ton, or $7,386,450.93 gross, from which it has realized a recovery of 92.5 per cent, or net returns of $6,832,652.46. This has been accomplished at a mining, milling, transportation, and general expense of $4.83 per ton, and a development expense of $1.94 per ton, making a gross operating expense of $6.77 per ton. The total gross earnings for the fiscal year, including lease royalties and miscellaneous earnings, are $6,598,870.96. The gross expenses were $1,572,251.30. The net profits are $5,026,619.66. * * * The total dividend disbursements to stockholders within he calendar year was approximately $5,000,000, or $1.40 per share.

The gross output for the calendar year 1909 exceeded that of the above fiscal year statement by more than $1,000,000, as the mill operated two months longer in the former period.

In September, 1909, a disastrous cave in the Hampton stope wrecked the old Combination 20-stamp mill and decreased the company's milling capacity by about 90 tons of ore per day, but plans were immediately made to increase the capacity of the large mill from 650 tons to 850 tons per day.

During the fiscal year, 40,668 feet, or nearly 8 miles, of development work was done, of which 27,469 feet were driven on company account and 13,199 feet by lessees. From the statement of the mill operations, it is noted that in—

> October an average of 649 tons of ore per day was milled at a cost of $1.915 per ton, with an extraction of 94.49 per cent as compared with 463 tons per day, $2.26 per ton costs, and an average extraction of 90.57 per cent in February, the first month when all the stamps were dropping. During the fiscal year, the 1,286 tons of ore shipped to smelters carried average values of $636.34 per ton and the 193,193 tons of ore milled contained gross average values of $34 per ton.

The Florence-Goldfield Mining Company was the second largest producer of the district. According to the published annual report for 1909, the company milled 34,824.6 tons of ore, of a gross value of $641,586, or an average value of $18.42 per ton. With a recovery of 92.12 per cent the bullion yield was valued at $591,036. In addition 174 tons of ore averaging $287.54 per ton, and carrying $49,994 in total values, were shipped to the smelters, making a total gross yield of $641,030 from 34,998 tons of ore. The mill began production on January 15, 1909, and was operated continuously during the year. The company did a large amount of development work in 1909 connecting the workings of the various leases with the main company workings. An increased tonnage was shipped from the Diamondfield Black Butte group, 5 miles northeast of Goldfield. The production from the Combination Fraction was practically equal to that of 1908. This property is equipped with a 20-stamp amalgamation, concentration, and cyaniding mill and is opened by a vertical shaft 770 feet deep, The Goldfield Belmont Mining Company shipped ore from its mine, 5 miles north of Goldfield. The St. Ives, Velvet, and Gold Horn mines, of the Goldfield Merger Mines Company, all located 1½ miles east of Goldfield, were being worked by lessees. At the Kendall mine, 3 miles from Goldfield, lessees made a small production. Likewise lessees made increased shipments from the Sandstorm mine, which was the point of discovery of the Goldfield district. Shipments were also made from the C. O. D.

mine and from the Gold Bar mine. Only six mines in the district made a yield exceeding $45,000 in total value and a number produced less than $1,000 in total values.

Gold Mountain district.—The metal yield in the Gold Mountain, or Bonnie Claire, district, in Esmeralda County, was one-fifth larger than in 1908, and was made up almost entirely of gold, the silver and lead forming a small percentage of the total. An increased gold product was won from crude smelting ore, but a decreased recovery was made from the retreatment of old tailings. Extensive operations were carried on in this district in the early "eighties." The largest producer in the district in 1909 was the new Bonnie Claire Company, which shipped crude ore to smelters from the Courbet and Rattlesnake groups, and concentrates from the latter group; the company was erecting a 100-ton stamp mill.

Hawthorne section.—The mines in the Pamlico, or Hawthorne, district made an increased gold yield in 1909. The bulk of the production was made by lessees milling ore from the old dumps of the La Panta and Pamlico groups, belonging to the Esmeralda Consolidated Mining Company. The Marlview Mining Company reported a shipment of silver ore from the Walker Lake district. In 1909 the property was operated by lessees who extracted the silver ore from old stopes.

Hornsilver district.—Four mines in the Hornsilver district produced 926 tons of ore which yielded $21,089 in gold and 65,627 fine ounces of silver. This was an increase of 340 tons of ore mined and of $17,572 in the gold yield; the silver output decreased 7,250 fine ounces. The Great Western Mining and Milling Company made a slightly reduced production of ore in which the silver value was about eight times as much as the gold. Gold was the chief value of the ore shipped from the Orleans mine. Lessees made small shipments of silver-gold ore from the Connector mine, 19 miles southwest of Cuprite. Gold values predominated in the ore shipped from the Sunset mine.

Lida district.—The deep mines of this section made a slightly reduced gold and silver production in 1909, but the increased placer yield from the Tule Canyon section brought the total of the district's 1909 output up to $1,566, or slightly in excess of the yield of 1908. At the Buster mine the ore was reduced in a 10-stamp amalgamation and concentration mill. A small shipment of gold ore, with small silver values, was made from the Storm Cloud mine.

Lone Mountain and Southern Klondike districts.—The Nevada Alpine Mining Company made greatly reduced shipments of silver-lead ores carrying small values in gold and copper. The mine lies 7 miles south of McLean's station on Lone Mountain. A trial shipment of silver-lead ores carrying some copper was shipped from the Santa Fe mines, 5 miles from Tonopah. A shipment of rich silver ore was reported from the Southern Klondike mine, 14 miles north of Goldfield.

Lucky Boy district.—Increased shipments of lead ores, rich in silver values and carrying small quantities of gold and copper, were sent to smelters in 1909 from the Lucky Boy district, a new producer in 1908. This district furnished approximately eight-tenths of the silver and nine-tenths of the lead produced in Esmeralda County in 1909, and ranked second to Tonopah district in silver yield, and second to Eureka district in lead output.

Pamlico district.—See Hawthorne district.

Pine Grove district.—The mines in this section did not produce in 1909, but with the completion of the Mason Valley Railroad to Mason City operations will probably be resumed.

Rawhide district (Regent district).—The mine production from Rawhide district in 1909 was 6,197 tons of ore, which yielded 7,546.59 fine ounces of gold, valued at $156,002, and 89,833 fine ounces of silver, valued at $46,713, or a total value of $202,715, and an average recovery of $32.71 per ton. In 1908 a yield of $125,475 in gold and $21,714 in silver, or a total value of $147,189, was recovered from 1,826 tons of ore, with an average yield of $80.61 per ton. Ninety-one dollars was won from placer mines. The total gold production increased $30,436, or about one-fourth, and the silver yield was more than doubled. The increase in total value was $55,435, or 38 per cent.

The large increase in tonnage from 1,826 tons in 1908 to 6,197 tons in 1909, together with the large decrease in the grade of ore treated, from $80.61 per ton to $32.71 per ton, represented the direct result of increased milling facilities in the district.

The 5,059 tons of crude ore sent to gold and silver mills yielded as bullion $85,336 in gold and $6,828 in silver, or an average recovery of $18.22 per ton. Nine tons of concentrates derived from this ore made an additional yield of $1,594 in gold and $260 in silver. This was more than five times as much ore as was milled in 1908, when 973 tons yielded an average of $37.48 per ton as bullion.

The crude ore shipped to smelters from Rawhide district in 1909 amounted to 1,138 tons and yielded $69,072 in gold and $39,625 in silver, or an average recovery of $95.52 per ton. In 1908 853 tons of smelter ore averaged $129.80 per ton in total values.

The production in 1909 was from 10 holding companies, but was the yield of approximately 35 mining and leasing companies, as leasing concerns did most of the mining in the district.

The Rawhide Coalition Mines Company's holdings made the largest production of any property in the district in 1909. The entire output was made by lessees, as no ore was mined on company account. Shafts from 1,000 to nearly 4,000 feet deep have been sunk on 9 of the 11 claims belonging to the company.

The second largest production in the district was made from the five claims of the Rawhide Queen Mines Company. Besides the parent company, four leasing companies produced ore from the Queen holdings.

Three other leasing companies also made some production from the Bald Hornet fraction claim.

Some ore was milled from the Mascot No. 1 mine. Ore was shipped to mills and smelter from the Rawhide Rector claim, and from the McMann mine, 22 miles east of Schurz, a carload of ore was shipped to the smelters.

Rhodes or Candelaria district.—The Mount Potosi Nevada Mining Company shipped gold and silver bearing lead ores to smelter, prior to May 15, 1909, when it closed the mine and sold all the surface improvements.

Santa Fe district.—Including the mines at Acme, Luning, and north of Mina and Sodaville, 10 producers in this district made a yield of 409 tons of ore, bearing $5,404 in gold, 19,088 fine ounces of silver, 34,877 pounds of copper, and 20,000 pounds of lead, with a total value of $20,724. There was a decrease of $9,337 in gold, which was nearly offset by an increase of $8,282 in the value of the silver product. Small increases were also made in the copper and lead yields, so that the total value was larger by $319.

A few cars of silver ores carrying some gold values were shipped from the Silver State group, 10 miles from Luning. A small shipment was made from the Heatherbell mine. Copper ore, carrying small silver values, was shipped from the old dumps at the Mastodon, Mary, and Cuba groups, 8 miles from Mina. The Nevada lead mines produced a carload of silver-lead ore.

Schurz district.—At the Virginia group, located 14 miles south of Schurz, the operators made a trial shipment of gold ore in 1909.

Silver Peak district.—Four mines of this district produced 150,931 tons of ore, which yielded $924,318 in gold, 14,675 fine ounces of silver, and 20,884 pounds of lead, with a total value of $932,847. This represented a small increase in output. This district was surpassed only by Goldfield and Tonopah in output of gold in Nevada. According to the published report of the Pittsburg Silver Peak Gold Mining Company, an average of 95 stamps of the total number of 100 were in continuous operation during the year. The average gross bullion returns from 150,359 tons of ore were $6.09 per ton. The company purchased the property of the Silver Peak Valcalda Gold Mining Company, so that the present holdings include the original Pittsburg Silver Peak, the Mohawk Alpine, and the Valcalda groups. Some ore was shipped from the Great Gulch mines, 2½ miles from Blair; the Goldfield Silver Peak Mining Company milled some ore, and silver-bearing lead ore was shipped from the Palmetto mine.

Silver Star district.—Small productions by 4 mines in the Silver Star district made a combined yield of $863 in gold, 11,915 fine ounces of silver, 315 pounds of copper, and 45,581 pounds of lead, with a total value of $9,060.

Yerington section.—A number of mines in the northwest part of Esmeralda County are near the town of Yerington in Lyon County. Lessees operating the Mountain View mine and on the Setting Sun group milled considerable ore, and lessees on the properties of the Walker River Reservation Gold Mining and Milling Company shipped a portion of the ore and milled the remainder.

EUREKA COUNTY.

Mine production of metals and their ores in Eureka County, Nev., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold.................fine ounces.	8,339.66	$172,396	21,027.26	$434,672	+12,687.60	+$262,276
Silver.....................do....	140,551	74,492	187,710	97,609	+ 47,159	+ 23,117
Copper..................pounds..	79,985	10,558	101,500	13,195	+ 21,515	+ 2,637
Lead........................do....	2,330,048	97,862	4,346,535	186,901	+2,016,487	+ 89,039
Total..................................	....	355,308	....	732,377	....	+ 377,069
Ore output..........short tons..	28,198	[a] 12.60	88,341	[a] 8.12	+ 60,143	− [a] 4.48

[a] Value per ton, placer product excluded.

The mines in Eureka County made materially increased production of all four metals. There were 29 producing mines in the county in 1909, including 6 placer mines. The 23 deep mines produced 88,341 tons, or 3 times as much ore as in 1908, but the average value per ton decreased from $12.60 to $8.12 per ton. This reduction of one-third in the average value per ton was principally due to the milling of greatly increased quantities of ore which averaged less than $5 per ton, but the shipment of a much larger tonnage of comparatively low-grade fluxing ore, from the Richmond-Eureka mines to the United States Smelting Company at Midvale, Utah, was also a factor in reducing the average grade of the ore.

There were 27,326 tons of siliceous ore sold or treated, constituting 31 per cent of the total tonnage, and the source of $147,834 in gold and 23,715 fine ounces of silver, valued at $12,332, or 34 per cent of the gold and 13 per cent of the silver yield of the county. There were only 1,474 tons of siliceous ore sold or treated in 1908.

Production of lead ores increased from 26,724 tons to 60,946 tons in 1909 and formed 69 per cent of the total tonnage, and yielding $271,978 in gold and 162,183 fine ounces of silver, or 63 per cent of the gold and 86 per cent of the silver produced in Eureka County.

The ore shipped to smelters from this county averaged $4.92 per ton in gold, $1.55 per ton in silver, and $9.66 per ton in all four metals, as compared with averages of $6.21 per ton in gold, $2.66 per ton in silver, and $12.34 per ton in all four metals in 1908. With a yield of 4,346,535 pounds of lead, or 44 per cent of the output of the State, Eureka County retained its rank as the largest lead-producing county in Nevada.

In a recent report of the United States Geological Survey, Bulletin 408, W. H. Emmons has described the geology and ore deposits in the Cortez, Mill Canyon, Mineral Hill, and Lynn districts in Eureka County, and any notes concerning the geology or ore deposits in the following district reviews have been taken from his report.

Buckhorn district.—In the summer of 1909 the new camp of Buckhorn was started on the east side of the Cortez Range about 5 miles from the old camp of Mill Canyon. The new discoveries were reached from Alpha, a station on the Eureka and Palisade Railroad, 90 miles south of Palisade, but since the latter road has been idle, owing to washouts, Beowawee has been the nearest railroad station. Conflicting reports have been made as to the grade of the ore, but the development work up to the end of 1909 was not sufficient to determine much as to the future of the new camp. The Buckhorn Mines Company began operations in September, 1909, and did 1,640 feet of development work.

Cortez and Mill Canyon districts.—Only 1 mine made a production in this section in 1909, a trial shipment of lead ore carrying gold and silver values being made by the Cortez Mining and Reduction Company.

> The mines at Cortez and Mill Canyon were discovered in 1863, and rich ore yielding several hundred dollars to the ton was hauled to Austin for treatment. * * * the production of Cortez and Mill Canyon since discovery is estimated at $10,000,000, the larger part of which was taken from the Garrison mine. * * * The principal deposits of the Garrison mine are very irregular chambers of ore in limestone. * * * [In the Mill Creek section], the ore bodies are fissure veins of silver ore in granodiorite, silver-lead replacement deposits in limestone, and ferruginous deposits of gold ore replacing limestone.[a]

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[a] Emmons, W. H., Bull. U. S. Geol. Survey, No. 408, 1910, pp. 101-106.

Eureka district.—The mines in Eureka district produced 87,936 tons of ore, which yielded $419,778 in gold, 179,315 fine ounces of silver, 90,100 pounds of copper, and 4,340,768 pounds of lead, with a combined value of $711,388, or more than 98 per cent of the value of the total production of the county. In 1908 the district total output was 28,000 tons of ore, $172,355 in gold, 109,826 fine ounces of silver, 72,477 pounds of copper, and 2,310,572 pounds of lead, with a total value of $337,174. Therefore, in 1909, there was over three times as much ore mined, the gold yield was more than two and one-half times as large, the lead output was nearly twice as much, and the silver and copper productions were both increased very materially, as compared with the output of 1908, so that the total value was more than doubled, and increased $374,214. These increases were principally due to the increased gold production at the Eureka Windfall mine and the increased yield of all four metals at the old Richmond Eureka mines, which more than doubled the quantity of ore mined and the metal yield therefrom. The United States Smelting Company operated the old Eureka Consolidated and the Richmond mines, 2½ miles from the railroad at Eureka, and shipped a large tonnage of $9 ore which was desirable for fluxing qualities to the company's smelter at Midvale, Utah. About one-half of the values were in gold, about one-third in lead, and the remainder was made up of silver and copper values, at a ratio of about 8 of silver to 1 of copper. This mine was the largest lead producer in the State, and was the source of more than two-fifths of the state yield in 1909. The main workings include 3 shafts from 700 to 1,200 feet deep.

The Eureka Windfall, the second largest producer of the district in 1909, supplied a quantity of rather high-grade gold ore to the smelters, but the bulk of ore, which was of lower grade, was treated in the company's own 220-ton cyanide plant. The mine is developed by 5,750 feet of work in addition to the 500-foot shaft. A reduced tonnage of lead ore, carrying gold and silver values, was made from the Bullwhacker mine, and the small shipments from the Beehive mine were larger than in 1908. Ore was shipped from the Cyanide group, until June, when the property was sold. Lessees operating on the Excelsior group, 5 miles from Eureka, shipped gold-silver-lead ore with the principal values in gold. The values in the ore shipped from the Silver Lick group on Adams Hill were about equally divided between gold and silver. Ten other properties made small shipments from this district in 1909.

Lynn district.—"The Lynn district, just east of a low divide at the crest of the Cortez Range, is about 20 miles northwest of Carlin. Gold was discovered in the district in April, 1907 * * *."[a]

There was no production from the lode claims of the district, but placer operations were carried on in the gulches which drain eastward from the principal lode mines. The combined yield from 6 mines totaled $14,856 in gold and $44 in silver, making this district second only to Manhattan as a source of placer gold. The mines were worked by sluicing for a while in the spring, then by rockers, and later in the season by "dry washers." The Lynn Mining Company operated the North Star No. 1 and No. 2 claims. Operations were carried on at the Compromise mines, the Lower Sheep Gulch mines, and at the Middle Sheep Gulch mines.

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[a] Op. cit., p. 87.

Maggie Creek section.—The Nevada Star mine, which is opened by a shaft 250 feet deep, was further developed in 1909. The mine is located 9 miles northwest of Carlin, on the ridge just west of Maggie Canyon. "The deposit is a small replacement vein in limestone, dips steeply eastward, and contains bunches of galena and lead and copper carbonates said to carry good values in silver."[a]

Mineral Hill district.—A number of shipments of silver ore were made from the Big Three mine in 1909 and then the property was abandoned.

Palisade or Safford district.—The mines in the Palisade section made a greatly reduced production in 1909.

> The district takes its name from James Safford, who discovered the Onondaga mine in 1881. The mines of the district have produced about $200,000 in silver, nearly all of which was taken from the Onondaga and Zenoli mines. * * * The deposits are fissure veins of silver ore, which carries among other minerals some antimony and arsenic compounds. * * *
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> The Zenoli mine lies about 1 mile southeast of Barth, in a small gulch which joins the Humboldt Valley. The mine was discovered by Italian prospectors in the "eighties" and was held by them for a number of years. * * * In 1907 the Zenoli Silver Copper Company was organized and since that time has been producing ore steadily. * * * The deposit is a well-defined fissure vein from 1 to 5 feet wide [in an andesite country rock]. * * * The sulphide ore is composed of quartz, calcite, barite, stibnite, gray copper, galena, pyrite, and chalcopyrite. In the upper levels there is considerable iron oxide, copper carbonates, and horn silver.[b]

Two carloads of copper ore were shipped from the Prince of Wales mine located 3½ miles from Cedar, a station on the Eureka and Palisade Railroad south of Palisade.

HUMBOLDT COUNTY.

Mine production of metals and their ores in Humboldt County, Nev., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold..................fine ounces..	13,217.36	$273,227	18,421.64	$380,809	+5,204.28	+$107,582
Silver..........................do....	39,552	20,963	80,639	41,932	+ 41,087	+ 20,969
Copper.....................pounds..	54,598	7,207	5,477	712	− 49,121	− 6,495
Lead..........................do....	38,024	1,597	60,488	2,601	+ 22,464	+ 1,004
Total value....................	....	302,994	....	426,054	....	+ 123,060
Ore output..............short tons..	11,507	[a] 26.30	11,544	[a] 36.85	+ 37	+ 10.55

[a] Value per ton, placer product excluded.

The mines of Humboldt County produced metals having a total value of $426,054 in 1909, an increase of $123,060, or 41 per cent, as compared with the production in 1908. The gold yield of $380,809 represented nearly nine-tenths of the metal value for 1909 as well as most of the increase in value. Chafey, National, and Seven Troughs districts were the source of 92 per cent of the county's gold production in 1909, and the yield of Chafey and National districts caused the gold increase. The county's silver yield of 80,639 fine ounces was double that of 1908 and was due to increased silver production in Seven Troughs, Rosebud, National, and Imlay districts. The mines of Gold Run district caused the increase of 59 per cent in the lead yield as well as the decrease of 90 per cent in copper. There were 46 producing lode mines in the county in 1909 (16 more than in 1908), including 28 gold, 7 silver, 1 copper, 3 gold and silver, and 7 silver-lead mines. Of a total of 11,544 tons of ore mined, 11,399 tons, or nearly 99 per cent, was siliceous ores, and this class of ore was the source of most of the gold and silver yield. The 123 tons of lead ore carried $689 in gold and 5,715 fine ounces of silver and the 22 tons of copper ores yielded 214 fine ounces of silver.

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[a] Op. cit., p. 87.

[b] Op. cit., p. 111.

The total average value per ton of Humboldt County ore was $36.85 in 1909, $26.30 in 1908, and $12.79 in 1907. This increase in the grade of the ore was principally caused by the yield of high-grade ore in Seven Troughs district in 1908 and the production of very high-grade ore, including metallics, from the new camp of National in 1909.

The 11,145 tons of ore sent to gold and silver mills yielded $327,728 in gold and $8,878 in silver, or an average recovery of $30.20 per ton as bullion. This ore also yielded 132 tons of concentrates, which carried $14,498 in gold, 8,519 fine ounces of silver, 892 pounds of copper, and 5,070 pounds of lead—or an average value of $143.39 per ton in gold and silver and of $145.92 per ton in all metals. Thus the 11,145 tons of ore treated in gold and silver mills yielded as bullion and in concentrates an average total value of $31.92 per ton.

The metal content of the 399 tons of crude ore shipped to smelters included $38,238 in gold, 55,044 fine ounces of silver, 4,585 pounds of copper, and 55,418 pounds of lead. This was an average value of $167.57 per ton in gold and silver and of $175.04 per ton in all metals. In 1908 there were shipped to smelters from Humboldt County 1,839 tons of crude ore, which averaged $58.01 per ton in total value. The notable increase in the grade of the smelter ore shipped in 1909 was owing to the fact that though there was a reduced tonnage of ore shipped from the Seven Troughs district, it carried higher gold and silver values, and also to the fact that some very high-grade ore was shipped from National. F. L. Ransome, of the United States Geological Survey, visited the Seven Troughs, Rosebud, Star, Unionville (Buena Vista), Humboldt, Fitting, Chafey (Dun Glen, Sierra), Kennedy, and Gold Run (Adelaide) districts, in Humboldt County, in the summer of 1908, and has given some general descriptions of these districts, and of some of the mines, in Bulletin 414, "Notes on some mining districts in Humboldt County, Nevada."

Ashdown district.—The mines in the Ashdown district made no output in 1909, and only a small amount of development work was done.

Chafey district.—Four mines in this district produced 6,401 tons of ore, which yielded $128,120 in gold, 7,931 fine ounces of silver, and small quantities of copper and lead in 1909. The total value was $132,273, or over one-half larger than in 1908. The largest production was made by the Chafey Mines Company from the Mayflower mine. The bulk of the ore was reduced in the company's 30-ton mill, but some of the better-grade ore and the concentrates were shipped to smelters. Some ore from the Auburn group, 4 miles east of Chafey, was milled in 1909. A quantity of high-grade gold ore was also shipped from near the surface at the Philadelphia mine.

Fitting district.—There was no production reported from this district in 1909. "Fitting, still better known by its old name of Spring Valley, and the settlement of American Canyon, about 2 miles to the south, were flourishing placer camps in the early eighties."[a] The Bonanza King mine is reported to have supplied ore to San Francisco, Cal., as early as 1884, but the lower-grade ores were milled at Mill City.

Gold Run or Adelaide district.—The Gold Run district, located 11 miles due south of Golconda, was organized in 1866. Ten mines in 1909 produced 1,863 tons of ore, which yielded $19,698 in gold, 5,886 fine ounces of silver, 4,485 pounds of copper, and 54,000 pounds of lead, with a combined value of $25,664. In 1908, 3,693 tons of ore yielded $12,572 in total value, but a goodly portion of the ore was concentrated and copper in the concentrates formed the chief value. In 1909 the gold product was a large increase over the output of 1908, and the silver and lead yields were substantially increased, but owing to the idleness of the Adelaide mine no ore was sent to the concentrating mill at Golconda and the copper production was but a fraction of the output of 1908. Lead ore carrying silver and gold was shipped from the Black Diamond mine and from the Gertrude mine. The principal gold production in 1909 was made from the Golconda Gold Ledge mine and was recovered as bullion in the company's mill at Golconda. Shipments of silver-lead ore carrying some gold were made from the Equal Standard, Last Chance, Silver Shield, and West End mines.

Imlay district.—The Imlay mine, 6 miles east of Humboldt House, was the principal producer in that section in 1909. The values averaged about $3 in gold to $2 in silver. The concentrates carried some copper and lead in addition to the silver and gold.

Kennedy district.—The Humboldt Nevada Mining Company (Limited) made no shipments in 1909.

National district.—National district probably attracted more attention than any other section of Nevada in 1909, due to the richness of the ore mined in the Stall Brothers' lease on the property of the National Mining Company. Development work began on this property in June, 1907. Many other leases were started and a number of companies were formed following the strike, but the very rich ore was only found on the Stall Brothers' lease in 1909, and in this lease the ore is said to be confined to the main fault plane.

> All of the high-grade ore extracted up to the present time, with the exceptions noted later, has been in the form of smooth bowlders and pebbles or in crushed quartz. The rocks vary in size from grains the size of a pinhead to pieces weighing 150 pounds. When small, they are scattered throughout the gouge and crushed quartz near the wall or fault plane and make from a foot to 18 inches of mill ore, assaying from $10 to several thousand dollars per ton. This mill ore is, however, confined strictly to the high-grade shoot and is necessarily limited in amount. * * * The east side of this break is a highly silicified rhyolite and the west side, where the ore occurs, is andesite.[b]

Litigation concerning lease rights stopped the work on the National mine for a part of 1909, so that the production from the district was materially curtailed.

Paradise Valley and Quinn River section.—There was no production from the deep mines in these sections, but the placer mines yielded a small recovery. A small clean-up was made at the Dutch Flat mine, which was being developed. The other returns were from small panning operations.

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[a] Ransome, F. L., Bull. U. S. Geol. Survey No. 414, 1909, p. 36.

[b] Cutler, H. C., Min. and Sci. Press, Nov. 5, 1910, p. 606.

Rosebud district.—The combined yield from 4 active mines in Rosebud district was $86 in gold and 10,302 fine ounces of silver, valued at $5,357. Lessees made a small yield from the Durango Gold group. On the Dreamland Rosebud mine 500 feet of development work was done and from it one trial shipment of high-grade silver ore was made. Ransome describes this mine as follows:

> East of the Brown Palace is the Dreamland, with a 100-foot vertical shaft and short drifts on two levels. The vein strikes N. 70 ° E. and is about vertical. It consists of a hard, dull-white cryptocrystalline quartz in pyritized rhyolitic flow breccia. Its maximum width is 1 foot, but it is irregular and splits at some places into stringers, and apparently is not very persistent.[a]

The quartz contains more or less disseminated argentite, and the ore is sorted and saved for shipment.

The Good News Mining Company shipped silver ore from surface workings. The completion of the Western Pacific Railroad has afforded this section a shorter wagon haul for ore shipping.

Seven Troughs district.—Twelve mines in this district produced 2,551 tons of siliceous ore, which yielded $128,671 in gold and 45,012 fine ounces of silver, valued at $23,406, or a total value of $152,077 and an average recovery of $59.61 per ton. In 1908, 10 mines produced 3,582 tons of ore, which yielded $180,501 in gold, $9,795 in silver, and small values in copper and lead, with an average yield of $53.14 per ton. There was less ore mined by 1,031 tons in 1909, or 29 per cent; the gold values decreased $51,830, or 29 per cent; and the total values decreased $38,282, but the grade of the ore was $6.47 per ton higher than in 1908. With these losses, the district was still the most productive section in Humboldt County in 1909 in gold, silver, and total value.

The ore treated in gold and silver mills amounted to 2,413 short tons and yielded as bullion $116,757 in gold and $4,581 in silver, or an average recovery of $50.28 per ton. Eighteen tons of concentrates derived from this ore carried $2,093 in gold and $84 in silver, or an average of $120.94 per ton.

There were 138 tons of crude ore shipped to smelters, carrying $9,821 in gold and $18,741 in silver, or a total value of $28,562 and an average yield of $206.97 per ton.

Only a fairly high-grade ore can be shipped from this district, because of the 30-mile wagon haul to the railroad at Lovelock.

The largest production in the district in 1909 was made from the Fairview mine. The second largest yield was from the Nevada Hercules mine. All of the ore from this property was milled in 1909. From the consolidated mines some ore was sent to a local mill. An increased yield was made from the Wihuja lease on the Seven Troughs Therian mines. The crude ore was sent to the Kindergarten mill at Seven Troughs and the concentrates were treated by the Darby Ore Reduction Company at Mazuma. Lessees made an increased yield from the Seven Troughs Buckhorn mines at Vernon. The Seven Troughs Florence Mining and Leasing Company operated a lease on the property of the Seven Troughs Mining Company, and made a substantial production. Less ore was mined than in 1908 at the Kindergarten mine. This mine is equipped with a 10-stamp amalgamation and concentration mill, which also handled custom ore in 1909.

Unionville (Buena Vista) district.—A small quantity of ore was mined and milled at the Arizona mine at Unionville. This old property was a prominent producer in 1862 and was worked almost continuously until 1880. It is estimated that this group of mines has yielded $3,000,000 from approximately 80,000 tons of ore. About 300 feet of new work was done on the old Manoa group in this district. A comparatively recent description of these properties is given by F. L. Ransome in Bulletin 414 of the U. S. Geological Survey.

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[a] Bull. U. S. Geol. Survey, No. 414, 1909 p. 27.

Winnemucca section.—There were 6 small producers in 1909 operating in the Florence mining district, at Dutch Flat, and other points near Winnemucca, and for tabulation purposes they have been grouped as in the Winnemucca section. The combined production was less than $1,000.

LANDER COUNTY.

There were 17 producing mines in Lander County in 1909, or 10 less than in 1908, yet the total value of the production increased $27,892, or 60 per cent. The metal yield from 2,080 tons of ore was, gold, 1,926.19 fine ounces, valued at $39,818; silver, 61,521 fine ounces, valued at $31,991; copper, 4,939 pounds, valued at $642; and lead, 53,116 pounds, valued at $2,284. The total value of $74,735 represented an average yield of $35.93 per ton. The output of 1908 was 1,998 tons of ore, with an average value of $23.44 per ton. This increase in value of $12.49 per ton in the grade of the ore was principally due to the production of high-grade gold ore in the new Hill Top district.

The 168 tons of ore sent to gold and silver mills yielded as bullion $4,797 in gold and $136 in silver, or an average recovery of $29.36 per ton. There were 1,449 tons of crude ore treated in concentrating mills in 1909, and the resultant 105 tons of concentrates carried $8,176 in gold, 47,310 fine ounces of silver, 2,446 pounds of copper, and 20,534 pounds of lead, with a total value of $33,978, or an average value of $23.45 per ton of crude ore and $323.60 per ton of concentrates.

The crude ore shipped to smelters from Lander County in 1909 amounted to 463 tons, and carried $26,845 in gold, 13,950 fine ounces of silver, 2,493 pounds of copper, and 32,582 pounds of lead, with a total value of $35,824, or an average yield of $77.37 per ton.

In Bulletin 408 of the U. S. Geological Survey, W. H. Emmons has given some brief descriptive notes on the geology and ore deposits of the following camps in Lander County: Cortez, Dean, Gray Eagle, Hill Top, Lander, Lewis, Maysville, Mud Springs, Pittsburg, and Tenabo.

Austin or Reese River district.—The mines of this section produced 618 tons of ore, which yielded $3,272 in gold, 9,127 fine ounces of silver, 1,562 pounds of copper, and 19,837 pounds of lead, having a total value of $9,074. The bulk of the ore was concentrated before shipping. The gold, copper, and lead production increased, but the reduced silver yield caused a decrease of $1,045 in total value as compared with 1908. At the Austin Manhattan mines the year was devoted to remodeling the mill and to cleaning out old workings.

Bannock district.—Late in the summer of 1909 a new camp, named Bannock, was established at the head of Philadelphia Canyon, 14 miles southwest of Battle Mountain, where a discovery and small production of rich gold ore on the property now belonging to the Nevada Omaha Mining and Milling Company was made.

Battle Mountain, Copper Basin, and Galena districts.—Four mines in these districts made a combined production of 292 tons of ore, which yielded $12,855 in gold, 9,238 fine ounces of silver, 354 pounds of copper, and 6,930 pounds of lead, having a total value of $18,003. The Iron Canyon Gold Mining Company shipped ore to the Salt Lake City smelters.

Cortez district.—The mines of Cortez district made a larger yield of metal values than any other district in the county in 1909. The principal values were in silver. The Cortez Metals Recovery Company shipped concentrates to the smelters. Some ore was also shipped from the Valley View mine, 3 miles northwest of Cortez, on the border of Crescent Valley.

> The country is an area of tilted limestone overlain by rhyolite and cut by porphyry dikes. * * * Between Cortez and the Valley View mine are numerous small outcrops of ore showing copper carbonates, and in the vicinity of the Valley View are several small veins of lead ore. The Valley View vein follows in a general way a dike of altered porphyry. * * * The vein is from 1 to 5 feet wide, strikes southeastward, and consists of white quartz, galena, pyrite, and silver chloride.[a]

Dean district.—The Freiberg mine was operated for 4 months in 1909 and some ore was shipped to smelters.

Hill Top.—A few cars of high-grade gold ore, carrying some values in silver and lead, were shipped in 1909 from Hill Top, a new camp in an old district about 18 miles southeast of Battle Mountain.

Kingston district.—A quantity of ore from the Kingston mine, 30 miles south of Austin at Kingston, was milled in the company's 60-ton stamp mill.

Lander district (including the mines at Lander, Tenabo, and Bullion Hill).—The yield from the mines of this section in 1909 was but a little over one-fourth as much as in 1908, and only 2 mines produced shipping ore as against 8 mines in the previous year.

> [At the Gold Quartz mine] the country rock is quartzite, cut by an intruding quartz-bearing porphyry and by basalt. * * * The ore is highly oxidized; about 75 feet below the surface the sulphides appear, arsenopyrite and pyrite predominating.
> * * * Lander, 2 miles northwest of Tenabo, is the oldest camp in the Bullion district and was the milling center for the district in the seventies and eighties, when the Lovie mines were being worked. The rocks of the area are siliceous and carbonaceous shales interbedded with quartzite and limestone and have a general southeastward dip. The sedimentary rocks are capped with andesite and cut by intrusive quartz porphyry.[b]

LINCOLN COUNTY.

Mine production of metals and their ores in Lincoln County, Nev., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold.............fine ounces..	25,073.05	$518,306	16,127.45	$333,384	−8,945.60	−$184,922
Silver....................do..	232,615	123,286	224,852	116,923	− 7,763	− 6,363
Copper...............pounds..	277,727	36,660	173,446	22,548	− 104,281	− 14,112
Lead....................do....	1,095,000	45,990	1,495,628	64,312	+ 400,628	+ 18,322
Total....................	....	724,242	....	537,167	....	− 187,075
Ore output.........short tons..	137,718	[c] 5.26	104,185	[c] 5.16	− 33,533	− [c] 0.10

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[a] Emmons, W. H., Bull. U. S. Geol. Survey No. 408, 1910, p. 106.
[b] Emmons, W. H., Bull. U. S. Geol. Survey No. 408, 1910, pp. 117-118.
[c] Average value per ton.

The total value of the metal yield of Lincoln County in 1909 was $537,167, a decrease of $187,075, or 26 per cent. The gold output fell off about one-third and formed most of the decrease in total value, and was caused by the shutting down of the Bamberger-Delamar mine in Ferguson district. The silver production of 224,852 fine ounces was a decrease of 3 per cent and only a little over three-fifths as much copper was shipped in 1909. The lead yield of 1,495,628 pounds was an increase of 37 per cent. Lincoln County ranked third as a source of lead in 1909.

Seventeen producing deep mines, 3 more than in 1908, yielded 104,185 tons of ore having an average value of $5.16 per ton, as compared with 137,718 tons with an average value of $5.26 per ton in 1908. Of siliceous ores there were 99,816 tons, or about three-fourths as much as in 1908, and this class of ore yielded $311,964 in gold, and 113,612 fine ounces of silver, or 94 per cent of the gold and one-half the silver produced in the county in 1909. Ninety-three per cent of the county's gold yield was recovered as bullion from siliceous ore, treated at gold and silver mills. The falling off in the production of this class of ore, caused the decreased gold and silver totals, as the lead ores increased from 1,631 tons in 1908 to 3,470 tons in 1909, and yielded larger quantities of both gold and silver. There were 899 tons of copper-lead ores shipped, or less than half as much as in 1908.

The bullion yield from 90,098 tons of ore sent to gold and silver mills in 1909 was $310,829 in gold and $21,737 in silver, or an average recovery of $3.69 per ton, as compared with 127,714 tons of mill ore, averaging $4.04 per ton in 1908.

The 13,674 tons of crude ore shipped to smelters yielded $21,957 in gold, 178,792 fine ounces of silver, 173,446 pounds of copper, and 1,495,628 pounds of lead, having a total value of $201,789, or an average value of $14.76 per ton. The re-treatment of 413 tons of old tailings made an additional recovery of $598 in gold and $2,214 in silver.

Chief or Caliente district.—One small shipment of gold ore carrying small silver and lead values constituted the entire yield from this section in 1909.

Ferguson or Delamar district.—The production of this district in 1909 was less than two-thirds as large as in 1908, and the decrease was caused by the permanent closing of the famous old Bamberger-Delamar mine on September 1, 1909. The 400-ton cyanide mill was dismantled and sold and the mine was virtually abandoned.

Eagle Valley district.—In 1909, 4 mines at Fay sent 782 tons of ore to gold and silver mills, which yielded as bullion $3,083 in gold and $161 in silver. The ore from the Buck group and from the Horseshoe group was treated in a 120-ton Chilean mill. At the Iris group, the ore was treated in a 30-ton arrastre.

Pioche district (including Pioche or Ely Range, Bristol, Highland, and Jack Rabbit districts).—Ten mines in Pioche district shipped 14,055 tons of ore which yielded at the smelters, $21,575 in gold, 182,923 fine ounces of silver, 173,446 pounds of copper, and 1,495,302 pounds of lead, having a total value of $203,541. Thus this district supplied most of the silver and practically all of the copper and lead yielded in the county in 1909. Among the districts of Nevada, Pioche ranked second to Ely in production of copper and third to Eureka and Lucky Boy in the yield of lead.

Compared with the output of 1908, the gold production increased $8,932, or 70 per cent, the silver decreased 9,351 fine ounces, or 5 per cent, the copper decreased 101,236 pounds, or 37 per cent, the lead increased 429,111 pounds, or 40 per cent, and the total value was larger by $7,955, or 4 per cent.

The combined yield of the Mendha, Prince, Nevada-Utah, and Bristol mines was valued at $194,302, or over 95 per cent of the district production. The Bristol group was the largest copper producer in the district, and this metal yielded two-thirds of the value in the ore in 1909. Silver and lead values predominated in the ore shipped from the Yuba East mine by the Boston and Pioche Mining Company. Lead ore carrying gold and silver was shipped from the Highland Mary mine, 8 miles from Pioche. The Mendha Nevada Mining Company made the largest yield in the district. Lessees made a shipment of silver-lead ore, bearing small gold values from the Poorman group. The second largest production in the district in 1909, was reported from the Prince mine, 3 miles from Pioche. The Pioche Metals group supplied 2 carloads of silver-lead ore to smelters.

LYON COUNTY.

The metallic yield of the mines of Lyon County in 1909 was 5,277.23 fine ounces of gold, valued at $109,090; 12,888 fine ounces of silver, valued at $6,702; 462 pounds of copper, valued at $60; and 2,698 pounds of lead, valued at $116; a total value of $115,968, of which over 94 per cent was in gold. Compared with the production in 1908 there was an increase of $20,901, or about one-fourth in gold, and of 269 fine ounces of silver, but the copper output decreased in quantity 100,387 pounds and in value $13,252. The lead output was a net gain as there was none shipped in 1908. The total value increased $7,779, or about 7 per cent.

Nineteen lode mines (7 more than in 1908) operating in 4 districts, produced 18,551 tons of ore with an average value of $6.24 per ton There was a small production from 1 placer mine. Over 84 per cent of the ore, or 15,622 tons, were treated in gold and silver mills, and had a bullion recovery of $102,158 in gold and $4,070 in silver, an average yield of $6.80 per ton. A small shipment of concentrates derived from this mill ore carried an additional value of $299 in gold and lead. Likewise a carload of crude ore sent direct to concentrating mills yielded some gold and copper. The 81 tons of crude ore shipped to smelters, carried $2,354 in gold and $5 in silver, or an average value of $29.12 per ton. An additional recovery of $4,120 in gold and $2,622 in silver was made from 2,830 tons of old tailings.

Dayton or Silver City district.—Fifteen deep mines in this section produced 17,943 tons of ore which yielded $100,628 in gold, 12,838 fine ounces of silver, 462 pounds of copper, and 2,698 pounds of lead, having a total value of $107,480. In 1908, 9 mines produced 13,675 tons of ore whose total value was $90,046. There was also a small placer yield from this district in 1909. The Nevada Mining Reduction and Power Company's holdings included the Haywood, Piedmont, Pride of the West, and Ida groups of claims, a total of 19 claims, which are located about 5 miles from the railroad. The company treated crude ore in its 18-stamp mill at the mines and re-treated old tailings at its cyanide plant at Dayton, and did approximately 1,500 feet of development work. Lessees on the Buckeye mine made a production from the upper levels of the mine and reduced the ore in the 15-stamp mill. There was 600 feet of water in the main 800-foot shaft. Ore from the Gold Coin mine was treated at the McTeague Custom mill. Lessees operated the Silver City mine, and treated the ore in the company's 25-ton rotary mill.

Ramsey district.—From the Ramsey Comstock mines some of the better grade ore was shipped and the remainder was treated in a 40-ton amalgamation mill.

Wellington district.—A small bullion yield was made by one mine in the southern corner of the county, near Wellington.

Yerington or Mason Valley district.—A small gold production resulted from the milling of ore from 2 mines in this section in 1909. The copper-mine operators made no shipments, as they were awaiting the completion of the Copper Belt Railroad which was building from Wabuska, on the Southern Pacific Railroad, south through the Mason Valley to Yerington and Mason City.

NYE COUNTY.

Mine production of metals and their ores in Nye County, Nev., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold............fine ounces..	148,733.10	$3,074,586	142,509.95	$2,945,942	−6,223.15	−$128,644
Silver..................do....	7,632,813	4,045,391	8,246,496	4,288,178	+ 613,683	+ 242,787
Copper..............pounds..	167	22	13,261	1,724	+ 13,094	+ 1,702
Lead.................do....	180,976	7,601	95,675	4,114	− 85,301	− 3,487
Total........................		7,127,600		7,239,958		+ 112,358
Ore output........short tons..	389,204	[a] 18.13	426,421	[a] 16.83	+ 37,217	− 1.30

[a] Value per ton, placer product excluded.

The total value of the metal production of the mines of Nye County in 1909 was $7,239,958, an increase of $112,358. With a silver yield of 8,246,496 fine ounces, valued at $4,288,178, or more than three-fourths of the State's production, Nye County continues to rank first as a source of silver. It ranked second to Esmeralda County in total gold production, but first as a producer of placer gold, and third to Esmeralda and Whitepine counties in quantity of ore mined and in total value of metal output.

The decrease of $128,644, or 4 per cent, in the gold output of the county was caused by large decreases in the gold yields from Tonopah and Manhattan districts. Bullfrog, Johnnie, and Round Mountain districts made notable increases in gold production.

The silver yield was larger by 613,683 fine ounces, or 8 per cent, principally because of the increased silver output from Tonopah.

The bulk of the copper production was mined in the Monte Cristo district. The total lead output from 7 districts in Nye County in 1909 was but a little more than one-half as large as was won from 4 districts in 1908. There were large decreases in the yields of Goldyke, Lodi, and Tybo districts.

Fifty-nine lode mines, operating in 16 districts in 1909, produced 426,421 tons of ore, with an average value of $16.83 per ton, as compared with an average recovery of $18.13 per ton from 389,209 tons of ore from 85 deep mines and 19 districts in 1908. Classified by the chief products, the 59 deep mines included 39 gold, 11 silver, 1 copper, 2 lead, 5 gold and silver, and 1 gold-silver-lead mines.

Of the total tonnage, 426,089 tons, or 99.9 per cent, was siliceous ore. This class of ore was the source of nearly the entire precious-metal yield. The 285 tons of lead ores carried $12,017 in gold and 44,804 fine ounces of silver, and the 47 tons of copper ores carried only 92 fine ounces of silver.

In 1909 nine-tenths of the ore, or 386,970 tons, was treated in gold and silver mills, with a bullion recovery of $2,101,739 in gold and $3,246,435 in silver, or an average yield of $13.82 per ton, of which $5.43 per ton was in gold and $8.39 per ton was in silver. The 1,644 tons of concentrates derived from this mill ore carried $133,607 in gold and $350,015 in silver, a total value of $483,622 in precious metals, and an average yield of $81.27 per ton in gold, $212.90 per ton in silver, and $294.17 per ton in both metals. The concentrates carried a very small lead product. Therefore the 386,970 tons of crude ore milled in 1909 yielded as bullion and in concentrates $2,235,346 in gold and $3,596,450 in silver, or an average total recovery valued at $15.07 per ton.

The 39,428 tons of crude ore shipped to smelters formed only 9 per cent of Nye County's ore production and carried $649,488 in gold, 1,326,652 fine ounces of silver, 13,261 pounds of copper, and 94,233 pounds of lead, with a total value of $1,345,033, or an average metal value of $34.11 per ton.

The re-treatment of 23 tons of old tailings caused an additional yield of $232 in gold and of $1,185 in silver.

Twenty placer mines in 1909 produced 2,944.88 fine ounces of gold, valued at $60,876 and 1,315 fine ounces of silver, valued at $684, or a total value of $61,560. Compared with 1908, this represented a decreased yield of $10,135 in gold and of 621 fine ounces of silver, or a total decrease in value of $10,477, or 15 per cent, in the placer yield, which was caused by the reduced placer production in the Round Mountain district.

Bellehelen district.—The production of this district was only one twenty-seventh as large as in 1908. The values per ton averaged about $2 in gold to $1 in silver. The Broken Hills Lease Syndicate treated some ore in a 5-stamp amalgamation and concentration mill, shipped a few tons of concentrates, and then abandoned the property in March, 1909. The Nevada Bellehelen Mines Company milled some ore and also shipped some from the Gazabo mine.

Berlin district.—There was an increased production from the Berlin mine, the sole producer of this district. The ore was treated in a 90-ton stamp mill and the concentrates were shipped to Salt Lake City smelters.

Bullfrog district.—In Bullfrog district, the second largest metal producer of Nye County, in 1909, 9 mines produced 77,248 tons of ore, which yielded $766,989 in gold, 289,348 fine ounces of silver, valued at $150,461, and a few pounds of copper and lead, combined value being $917,473. Compared with the yield of 13 mines in this district in 1908 there was an increase of 12,715 tons of ore, $121,532 in gold and $110,556 in total value. The silver yield decreased in quantity 13,293 ounces and in value $10,999.

The 68,986 tons of ore milled in 1909 yielded as bullion $436,990 in gold and $142,074 in silver values, or an average recovery of $8.39 per ton.

The smelters received 8,262 tons of crude ore from this district, carrying $329,999 in gold and 16,129 fine ounces of silver, and the small copper and lead production, or an average total metal value of $40.96 per ton. A decreased quantity of ore was shipped from the Diamond Queen mine, 9 miles southeast of Beatty. Lessees shipped a small tonnage of gold ore from the National Bank mine, a quarter of a mile east of Rhyolite. Important smelter shipments were made from the Bimetallic and the Conservative claims, located 3 miles southwest of Springdale. At the Mayflower Bullfrog Consolidated mine, 2 miles from Springdale, at Pioneer, the ore was treated in a 30-ton stamp mill. The largest production from this district was made from the properties of the Montgomery Shoshone Consolidated Mining Company (the holding corporation for the Montgomery Shoshone Mines Company), the Shoshone Polaris Mining Company, and the Bullfrog Reduction and Water Company. The last-named company operates a 150-ton concentration and cyanide mill and treats the ore from the mines of the first two companies. Both the Shoshone and the Polaris mines are located about 1¼ miles northeast of Rhyolite. Lessees made smelter shipments from the Denver and Hobo mines, which lie about 1 mile southwest of Rhyolite.

Cactus Range district.—A small shipment of silver ore carrying some gold values was made in 1909 from the Cactus Johnnie mine, located in the Cactus Range district about 20 miles east of Goldfield. Sydney H. Ball has described the geology of this section in detail in Bulletin No. 308 of the U. S. Geological Survey.

Cloverdale or Golden district.—There was a small production in 1909 from the Mammoth mine, located about 35 miles northeast of Millers. Lessees worked the United Verde mines, but the other holdings in this section were idle during 1909.

Goldyke or Atwood district.—The 120 tons of ore shipped from the mines of this district in 1909 yielded $3,166 in gold, 5,579 fine ounces of silver, and 10,023 pounds of lead, the total value being $6,498. This production was about three-fourths as large as that of 1908. The ore was hauled 35 miles to Luning for shipment to smelters. The January mine was being developed. The ore shipped from the Garfield group was taken from old stopes and from the dump in 1909. Lessees made a production from the Pactolus mine.

Hannapah district.—The Silver Glance mine in the Hannapah section was worked by lessees who shipped silver ore carrying small gold values to Tonopah mills and to smelters.

Ione district.—The Midas Placer Mines Company made a small clean-up from its placer claims near Ione. The gold averaged 0.796 in fineness.

Johnnie district.—An increased tonnage of ore was milled in this district in 1909, but it was of a lower grade than in 1908; the bullion yield of $105,846 in gold and $392 in silver was nearly three times as large as the output of 1908, the first year this district yielded a production. The Crown Point ore was treated in a 1-stamp Kendall mill. The mine is 2 miles from Johnnie and about 12 miles from

Amargosa. The Johnnie produced an increased tonnage of ore, which was treated in the 85-ton amalgamation mill, containing 16 Nissen stamps, and a 10-foot Lane mill.

Lodi district (including mines at Bob, Lodivale, and Marble).—The 201 tons of ore, most of which was lead ore, sent to smelters from this district, yielded $11,108 in gold, 42,690 fine ounces of silver, and 57,326 pounds of lead, the combined value being $35,772. The Lodi Mines Company operated the Illinois mine, at Bob, about 45 miles from the railroad at Luning. The owners of the July mine at Lodivale shipped a small quantity of high-grade ore and performed some shaft and tunnel work. A few cars of lead ores, carrying silver and gold, were shipped from the Smuggler mine in 1909.

Manhattan district.—The total value of the metals produced in Manhattan district in 1909 was $124,942, which represented a decrease of $142,732, or over 53 per cent, as compared with the total value of the production in 1908. Thirteen deep mines produced 4,198 tons of ore which yielded in bullion $76,691 in gold and $907 in silver, a total value of $77,598, and an average recovery of $18.48 per ton. This was a decrease of 6,571 tons of ore and $173,705 in total value. On the other hand, 16 placer operators in this district produced $46,847 in gold and $497 in silver, or a total value of $47,344. This was an increase of $30,973, or nearly three times as much as the placer yield in 1908. This district was the source of nearly 57 per cent of the placer yield of the State in 1909. In March and April, 1909, the placer mines were located for a distance of 3 miles down the gulch below Manhattan, and numerous lessees began developing by means of shafts and drifts. The values ranged from 2 to 4 feet above bed rock, which varied in depth from about 40 feet near Manhattan to over 80 feet 3 miles farther down the gulch. The fineness of the gold ranged from 0.702 to 0.728 and averaged about 0.710.

The Nellie Gray and Mustang Extension leases made the largest yield in 1909. This property was equipped with a 3-horsepower gas engine and rotary screen for washing the gravel. A comparatively large production was also made from the African claim. Lessees also mined gravel on the Golden Gate, Morning Star, Little Gray, September Fraction, and Wolftone Extension mines and on the holdings of the Verde Mining Company. The Dexter King and Robust mines and the Evening Star and Morning Star mines were also operated.

A substantial ore production was made from the lode mines of the Manhattan Dexter Mining Company by numerous lessees. The Dexter ground was worked and the Indian Camp and Stray Dog mines were operated. On the latter a 10-stamp amalgamation and cyanide mill was worked partly as a custom plant. Lessees made outputs from the Manhattan Broncho, Mayflower, Manhattan Consolidated, Big Four, Earl, Thanksgiving, and Wolftone mines in 1909.

Millet district.—A small shipment of lead ore carrying silver and gold was reported from the Millet section north of Round Mountain and near the Lander County line.

Round Mountain district.—The total value of the yield from the mines of Round Mountain district in 1909 was $508,402, an increase of $60,871, or 14 per cent.

Eleven deep mines produced 41,838 tons of ore which yielded $486,763 in gold and $7,568 in silver, a total value of $494,331 and an average recovery of $11.82 per ton. This represented an increase of $102,098, or 26 per cent, as compared with the lode mine output of 1908. There was one small lot of ore shipped to smelters in 1909, but practically the entire product was in the form of mill bullion. The placer yield included $13,885 in gold and $186 in silver, a total value of $14,071, or a little more than one-fourth as much as the placer output of 1908.

The Round Mountain Hydraulic Gold Mining Company used a 2-inch nozzle in hydraulicking the gulch gravels, and sluicing operations were carried on by lessees on the Blue Jay and the White Horse Fraction placers.

The Round Mountain Mining Company was the principal producer of the district. The ore is treated in a 100-ton amalgamation mill using stamps, Huntington mills, and tube mills. A substantial production was made by lessees from the Round Mountain Blue Jacket mine, a group of 5 claims and 2 fractions. Ore from the Daisy mine was treated in a 35-ton amalgamation mill. A slightly increased production was made from the Fairview Round Mountain mine. The ore was treated in a 5-foot Huntington mill. The Round Mountain Sphinx mine was also operated. A 40-ton Huntington mill, in 1909, was erected on the Jefferson mine.

Other districts.—No production was reported from the Kawich, Liberty, and Golden Arrow districts.

TONOPAH DISTRICT.

Mine production of Tonopah district, Nye County, Nev., 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold........fine ounces..	78,584.75	$1,624,491	67,742.46	$1,400,361	−10,842.29	−$224,130
Silver..........do....	7,172,396	3,801,370	7,872,967	4,093,943	+ 700,571	+ 292,573
Copper..........pounds..	....	....	1,784	232	+ 1,784	+ 232
Lead..........do....	....	....	1,488	64	+ 1,488	+ 64
Total value..........	....	5,425,861	....	5,494,600	....	+ 68,739
Ore output......short tons..	273,176	[a] 19.86	278,743	[a] 19.71	+ 5,567	− [a] 0.15

[a] Value per ton.

Tonopah district.—The mine production of Tonopah in 1909 of 278,743 tons of ore with a combined metal yield valued at $5,494,600, was the largest in the history of the district, exceeding the total value of the output of 1908 by $68,739. The decrease of $224,130 in the value of the gold output was offset by an increase of $292,573 in the value of the silver produced in 1909. The increase in quantity of silver was 700,571 fine ounces, or 10 per cent. Tonopah district yielded more than 95 per cent of the silver and nearly one-half of the gold produced in Nye County, and 72 per cent of the state output of silver in 1909. There was a small quantity of copper and lead in the ores shipped to the smelters from one Tonopah property in 1909.

The ore output increased by 5,567 tons, but the total average value per ton decreased $0.15. In 1909 the ore averaged $5.02 per ton in gold and $14.69 per ton in silver, as compared with an average value of $5.95 per ton in gold and $13.91 per ton in silver in 1908.

Eighty-nine per cent of the ore production, or 248,044 tons, was treated at gold and silver mills and yielded as bullion $967,545 in gold, an average value of $3.90 per ton, and $3,090,370 in silver, an average value of $12.46 per ton. The total value recovered as bullion was $4,057,915, an average yield of $16.36 per ton, in 1909, against $4,021,755, an average value of $15.07 per ton, in 1908. From the mill ore 1,587 tons of concentrates were saved, which yielded $131,588 in gold and $346,761 in silver, a total value of $478,349 and an average recovery of $301.42 per ton. Thus from the crude ore sent to mills in 1909 from Tonopah district there was a combined yield, as bullion and from concentrates, of $1,099,133 in gold and $3,437,131 in silver, a total of $4,536,264 and a total average saving of $18.29 per ton, as compared with a similar yield of $19.21 per ton in 1908.

The crude ore shipped to smelters from Tonopah district totaled 30,676 tons and yielded $300,996 in gold, or $9.81 per ton, and $655,627 in silver, or $21.37 per ton. Including the value of the small copper and lead content, the smelting ores carried a total value of $956,919 and an average value of $31.19 per ton. The re-treatment of 23 tons of slag in this district yielded $232 in gold and $1,185 in silver values.

The following table shows the gold and silver production of the Tonopah district from 1902 to 1909, inclusive:

Mine production of gold and silver in Tonopah district, Nye County, Nev., from 1902 to 1909, inclusive, in fine ounces.

Year.	Gold.		Silver.		Total value.
	Quantity.	Value.	Quantity.	Value.	
1902	26,462.58	$547,030	2,434,453	$1,217,241	$1,764,271
1903	25,297.61	522,948	2,404,180	1,274,215	1,797,163
1904	18,703.03	386,626	2,115,191	1,205,659	1,592,285
1905	58,356.99	1,206,346	5,369,439	3,243,141	4,449,487
1906	63,113.75	1,304,677	5,697,928	3,817,612	5,122,289
1907	57,250.36	1,183,470	5,330,398	3,518,063	4,701,533
1908	78,584.75	1,624,491	7,172,396	3,801,370	5,425,861
1909	67,742.46	1,400,361	7,872,967	4,093,943	5,494,304
Total	395,511.53	8,175,949	38,396,952	22,171,244	30,347,193

The mines and mills of Tonopah maintained a steady production during 1909, accompanied by the opening of sufficient new ore reserves to permit most of the companies to make very favorable comments in their annual reports as to future work. The building of the new 30-stamp mill for the Tonopah Extension Mining Company was the most important surface development during the year.

The Tonopah Mining Company's production for 1909 comprised nearly three-fifths of the tonnage and total value yielded in Tonopah district. The following statements have been taken from the printed annual report of the company for the fiscal year ending February 28, 1910, and, in a measure, are typical of conditions in this great silver camp in 1909:

> During the year 231,986 wet tons of ore and waste were hoisted from the Mizpah, Silver Top, and Red Plume shafts, of which 166,078 dry tons of ore of an average value of $20.93 per ton were shipped to the Desert Power and Mill Company and 5,997 dry tons of low-grade ore were placed near the railroad spurs on the surface. * * *

There were milled and treated 166,174 dry tons of ore averaging 0.313 ounce gold and 28.05 ounces silver per ton, with a total metal content of 52,023 ounces gold and 4,658,296 ounces silver, from which there were recovered by concentration and shipped to smelter 1,335.5 dry tons of concentrates averaging 5.03 ounces gold and 736.54 ounces silver per ton, a total of 6,722 ounces gold and 983,643 ounces silver. * * *

The sand and slimes treated by the cyanide process yielded 40,553 fine ounces gold and 3,282,422 fine ounces silver. * * * The recoveries made by the mill for the year were by concentration 12.9 per cent of the gold and 21.1 per cent of the silver content of the ore, and by cyanidation 78.1 per cent of the gold and 70.6 per cent of the silver content of the ore, or a combined extraction of 91.7 per cent.

The average costs per ton were as follows: Mining $4.17, milling $3.18, milling losses $1.78, and freight $1.38, or a total cost of $10.51. The average gross value of ore was $20.93, leaving a profit of $10.42 per ton. The company did 20,877 feet of development work and 1,996 feet of core drilling in 1909.

Lateral development in the earlier andesite, and to a much less extent in the upper rhyolite, resulted in opening up new ore in all parts of the mines, the most valuable development being the Red Plume vein and a parallel vein to the north, the Mizpah fault vein and new veins in the Silver Top shaft workings. Smaller veins of commercial ore scattered throughout the entire mine workings have also aided in increasing the ore reserves 47,535 tons over the reserves of last year. * * * The estimated ore reserves on March 1, 1910, were 414,583 tons, of a gross value of $21.93 per ton, or a total value of $9,094,847. * * * Deep development has been carried on by sinking the Mizpah shaft to a depth of 1,517 feet, and has been all in lower rhyolite below the 900-foot level. From a point on the 1,500-foot level, a drill hole was driven down vertically 653 feet in lower rhyolite. * * * The results of deep development in the Mizpah shaft so far have been negative.

The second largest producing company in the district was the Tonopah Belmont Development Company, which did 7,286 feet of development work on its holdings, which are opened by 2 shafts, one 1,127 feet deep and the other 1,055 feet deep. This company operated a 180-ton concentration and cyanidation mill at Millers, and treated ores from several other Tonopah mines, including the Jim Butler Tonopah mine which is opened by 2 vertical shafts, respectively, 502 feet and 686 feet deep. About two-thirds of the ore from the MacNamara mine was shipped to smelters and the remainder was milled. There were 3,434 feet of new work done in this mine during 1909. The Montana Tonopah Mining Company treated some of the MacNamara ore in addition to its own tonnage in its 140-ton concentrating and cyaniding mill at Tonopah. Development at the Montana Tonopah mine amounted to 8,015 feet of work. The West End Consolidated Mining Company increased its production. The Tonopah Midway Mining Company performed 6,346 feet of development work and made a reduced output in 1909 as compared with 1908. The Mogul Consolidated mines made a small production in 1909. The Tonopah Extension Mining Company suspended mining operations for seven months during 1909 while the new 30-stamp cyanide mill was being erected.

ORMSBY COUNTY.

A trial shipment of copper ores, bearing gold and silver, was made from the Two Brothers mine, located 5 miles from Brunswick in the Delaware district. The ore was extracted in doing development work in 1909.

STOREY COUNTY.

Mine production of metals in Storey County, Nev., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold ..... fine ounces..	29,006.47	$599,617	26,926.54	$556,621	−2,079.93	−$42,996
Silver ..... do....	542,017	287,269	501,625	260,845	− 40,392	− 26,424
Lead ..... pounds..			1,861	80	+ 1,861	+ 80
Total		886,886		817,546		− 69,340
Ore output ..... short tons..	113,908	[a] 7.79	92,092	[a] 8.88	− 21,816	+ [a] 1.09

[a] Value per ton.

Storey County, with an area not exceeding 260 square miles, was once the most productive county in the United States, but ranked after Esmeralda and Nye counties in Nevada in 1909 as a source of precious metals. Twenty-two mines in the Comstock district produced 92,092 tons of siliceous ore, which yielded an average value of $8.88 per ton. Compared with the output of 1908 the gold production decreased 7 per cent and the total values were 8 per cent less. The average ratio of gold to silver has increased in Comstock ores.

In 1909 there were 45,056 tons of ore treated in gold and silver mills, which yielded as bullion $140,041 in gold and $44,487 in silver, a combined recovery of $184,528, or an average value of $4.10 per ton. There were 297 tons of concentrates derived from this mill ore which carried $54,379 in gold, 44,315 fine ounces of silver, and 1,861 pounds of lead, with a total value of $77,503. Therefore, the total yield from the 45,056 tons of mill ore, including bullion and in concentrates, was $262,031, an average value of $5.81 per ton. The 32,974 tons of crude ore sent to concentrating mills produced 927 tons of concentrates (a reduction of about 36 into 1), and yielded $212,440 in gold and $96,716 in silver, an average value of $9.43 per ton of crude ore. The crude smelting ore shipped direct to smelters in 1909 carried $138,071 in gold and $92,130 in silver, a total value of $230,201.

The re-treatment of 13,958 tons of old Comstock mill tailings caused an additional bullion yield of $11,690 in gold and $4,468 in silver.

The largest production from the county in 1909 was from the Ophir mine, the first producer on the Comstock Lode. The bulk of the ore was treated in custom mills, but a small tonnage of high-grade ore was shipped to smelters. A small test lot of ore was extracted from the Belcher mine which was worked through the Yellow Jacket shaft. The Crown Point ore was treated in part in the Yellow Jacket mill and the remainder was sold to local mill companies. The Silver Hill Mining Company sent a smaller tonnage to custom mills in 1909 than in 1908. The output of the Yellow Jacket mine increased. Development work has been carried on at this mine with the view of milling a large tonnage of low-grade ore. At the Andes mine the ore was treated in a Kinkead mill. The second largest yield from the Comstock in 1909 was made from the Chollar and Potosi mines which were operated by Charles Butters & Co. (Ltd.). This company has a 250-ton stamp mill and cyanide plant. The Comstock Phoenix Mining Company did 2,490 feet of development work and sent some ore to the Butters plant.

The Fisher Mill and Mine Company operated a 5-stamp mill, equipped with amalgamating plates, Washoe pans, concentrators, and cyanide tanks. The Consolidated-Virginia, Brunswick Lode, and Savage mines also produced in 1909. Operations were suspended for the first six months of 1909 at the Hale & Norcross mine because of the fire in the Sutro tunnel, and the last half of the year was spent in repairing the damage done to the mine by flooding. The mine was being worked to a depth of 1,640 feet. The Ward Shaft Association spent most of 1909 in cutting stations and overhauling the surface improvements preparatory to installing a new pumping plant. Development work was carried on at several other mines.

WASHOE COUNTY.

Eleven mines in Washoe County in 1909 produced 4,238 tons of ore, which yielded 1,368.48 fine ounces of gold, valued at $28,289, and 806 fine ounces of silver, valued at $419, a total value of $28,708, and an average yield of $6.77 per ton. Gold formed the chief product of all the mines and all of the ore was siliceous.

Nine mines in 1908 produced 968 tons of ore, which yielded $14,156 in gold, 304 fine ounces of silver, and 4,197 pounds of copper, with a total value of $14,871, and an average value of $15.36 per ton. Thus, in 1909, the gold output was doubled and the total value of all metals was increased $13,837, or 93 per cent, principally by the increased production from the Jumbo or West Comstock district. There were treated in gold and silver mills 3,528 tons of ore, which yielded as bullion $20,802 in gold and $238 in silver, or an average recovery of $5.96 per ton.

Jumbo district.—About five-sevenths of the tonnage and one-half of the total metal values produced in the county were yielded by 4 mines in the Jumbo section. The Bargo Mining and Milling Company, the largest producer, operated a 10-stamp mill equipped with amalgamating plates and 4 Frue vanners. The ore from the Fink & Mahoney mine was sent to a custom mill.

Olinghouse or Whitehorse district.—Four mines in this district yielded $5,855 in gold and $68 in silver in 1909. The total value, $5,923, was a decrease of $893, as compared with the output of 1908.

At the Keystone mines, located 9 miles from Wadsworth, the ore was treated in Huntington mills. The Texas-Nevada, Buckeye Buster, and Woodchopper mines were producers in 1909.

Reno section (including Peavine district).—The total value of the production from several mines near Reno in 1909 was $8,537, of which $8,344 was in gold. The Nevada Central production was from a test mill run in 1909.

Leadville section.—Development work only was done in the Leadville section.

WHITEPINE COUNTY.

Mine production of metals in Whitepine County, Nev., 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold...........fine ounces..	5,030.61	$103,992	18,551.47	$383,493	+ 13,520.86	+ $279,501
Silver..................do....	83,017	43,999	110,325	57,369	+ 27,308	+ 13,370
Copper............pounds..	14,839,493	1,958,813	57,508,146	7,476,059	+42,668,653	+5,517,246
Lead.................do....	1,595,882	67,027	1,043,629	44,876	− 552,253	− 22,151
Total......................	....	2,173,831	....	7,961,797	....	+5,787,966
Ore output......short tons..	433,777	[a] 5.01	1,675,328	[a] 4.75	+ 1,241,551	− [a] 0.26

[a] Value per ton, placer gold excluded.

The total value of the mine production of metals in Whitepine County in 1909 was $7,961,797, or $5,787,966 in excess of the value of the yield of 1908. The bulk of this increase, or $5,517,246, represented the increase in value of copper output, and the larger gold and silver outputs were both caused by the increase of copper ores. The reduced lead product was due to decreased yields of lead ores from the Hamilton and Ward districts.

Whitepine County ranked first in quantity of ore mined in 1909, with a yield of 1,675,328 tons, or 56 per cent of the total tonnage of the State. This county was also the source of more than 99 per cent of the copper production of the State in 1909.

Five placer mines and 22 lode mines produced in 1909. Classified by chief products, the deep mines included 3 gold, 3 silver, 6 copper, 7 lead, 1 gold and silver, 1 gold and lead, and 1 silver-lead mines. The yield from the placer mines was $2,676 in gold, and $16 in silver values.

The copper ores amounted to 1,670,010 tons, or nearly 99.7 per cent of the county's ore output, and were the source of $365,646 in gold and 71,477 fine ounces of silver, or 95 per cent of the gold and 65 per cent of the silver yield of the county. The 3,110 tons of siliceous ores carried $8,518 in gold and 19,240 fine ounces of silver, or 17 per cent of the silver output. The 2,208 tons of lead ores carried $6,653 in gold and 19,577 fine ounces of silver, or 18 per cent of the silver yield.

Compared with the ores produced in 1908, the siliceous ores increased 1,908 tons, lead ores decreased 113 tons, no copper-lead ores were reported, but the copper ores increased nearly four-fold.

More than 98 per cent of the ore mined in Whitepine County in 1909, or 1,648,848 tons, were sent to concentrating mills and the resultant 197,408 tons of concentrates yielded $355,207 in gold, 84,273 fine ounces of silver, 54,905,292 pounds of copper, and 28,000 pounds of lead, with a combined value of $7,537,921, or an average yield of $38.19 per ton, equivalent to a value of $4.57 per ton of crude ore.

The 26,420 tons of crude ore sent to smelters in 1908 carried $22,123 in gold, 25,965 fine ounces of silver, 2,602,854 pounds of copper, and 1,015,629 pounds of lead, with a total value of $417,668, and an average recovery of $15.91 per ton. Only 60 tons of ore were treated in gold and silver mills, and the bullion yield was $3,487 in gold and $29 in silver value.

The principal events of interest in Whitepine County in 1909 concerned the developments and increased productions at the large copper mines in the Robinson district about Ely.

Blackhorse district.—Development work only was done in the Blackhorse district.

Cherry Creek district.—Five mines in Cherry Creek district produced 3,078 tons of ore, which yielded $6,724 in gold, 20,125 fine ounces of silver, 315 pounds of copper, and 56,744 pounds of lead, with a total value of $19,670. In 1908 the copper and lead yields were much larger, but less gold and silver was produced.

Ore from the Star Grey Eagle mine was concentrated in a 75-ton mill, and lead concentrates carrying gold and silver were shipped to Utah smelters. The North Mountain and the Wide West mines were also producers in 1909.

Granite district.—The Bunker Hill and Sullivan Mining Company, operating in the Granite district near Cherry Creek, made increased shipments of lead ores in 1909.

Duck Creek district.—A few cars of silver-bearing copper ores were shipped from the Duck Creek district in 1909.

Mine production of metals and their ores in Robinson district, White Pine County, Nev., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold .... fine ounces..	4,568.68	$94,443	17,926.28	$370,569	+ 13,357.60	+ $276,126
Silver .... do....	30,381	16,102	79,487	41,333	+ 49,106	+ 25,231
Copper .... pounds..	14,797,295	1,953,243	57,481,515	7,472,597	+42,684,220	+5,519,354
Lead .... do....	2,381	100	524,512	22,554	+ 522,131	+ 22,454
Total value...........	....	2,063,888	....	7,907,053	....	+5,843,165
Ore output...... short tons..	430,031	[a] 4.80	1,671,225	[a] 4.73	+ 1,241,194	[a] −0.07

[a] Value per ton, placer product excluded.

Robinson (Ely) district.—In 1909 the lode mines of Robinson, or Ely, district made a metal yield valued at $7,906,866 and firmly established the district as one of the great copper-producing sections of the United States. The placer yield of the district was insignificant. The copper output of 57,481,515 pounds represented more than 97 per cent of the copper yield of Nevada and nearly half of the State's increase in total values. As shown in the table, there was a large increase in the yield of each metal in this district. The increase in precious metals was principally due to the great tonnage of copper ores.

Of the 10 producing deep mines in the district, 5 yielded 1,669,909 tons of copper ores, 4 produced 1,304 tons of lead ores, and 1 produced siliceous ore. Thus the larger lead output represented an increased activity at the lead mines and not a by-product of the big copper mines.

In 1909, 1,645,835 tons of crude ore sent to concentrating mills produced 197,233 tons of concentrates, containing $350,313 in gold, 66,244 fine ounces of silver, and 54,905,292 pounds of copper, or a total value of $7,522,448. The crude-ore recovery in concentrates averaged

21 cents in gold, 0.04 ounce of silver, and 1.66 per cent of copper, or $4.57 per ton. The ratio of concentration was 8.34 into 1, and the average value per ton of concentrates was $38.14 per ton. This class of ore represented more than 98 per cent of the ore production of the district, and was mined at the Nevada Consolidated, the Giroux Consolidated, and the Cumberland-Ely mines.

Eight lode mines supplied 25,390 tons of crude shipping ore to smelters in 1909, which carried $20,070 in gold, 13,240 fine ounces of silver, 2,576,223 pounds of copper, and 524,512 pounds of lead, or a total metal value of $384,418 and an average value of $15.14 per ton, of which $13.19 per ton represented copper. The principal ore-bearing rock of the district is monzonite porphyry, but a fissure of high-grade carbonates of copper occurs in the main workings at Copper Flat.

The Nevada Consolidated mines were the principal producers in 1909. This property included the old Eureka mine, now known as the Copper Flat property, and the Ruth mine, which lies to the east of Copper Flat. Both mines are in the porphyry belt, and the ores are similar, but because of the deep capping at the Ruth mine the ores are mined underground, while at the Copper Flat property the mining is done by 5 steam shovels, which had stripped about 15 acres up to the end of 1909. Three shovels are used for stripping the capping and 2 for mining and loading ore. It has been estimated that by working to a depth of 200 feet about 12,000,000 tons of ore can be extracted by steam shovels at a profit with the present prices of copper and costs of smelting. The actual cost of mining ore is stated to be $0.153 per ton, with an additional allowance of $0.15 per ton for cost of stripping and keeping the pit clear.

The production of the Cumberland-Ely Company was mined from the old Veteran mine, on the west end of the mineralized belt. The ore is reported to occur as a large porphyry dike cutting through the limestone. A surface capping of average depth of 200 feet prevents steam-shovel mining. The ore, which is soft and easily broken, was worked by the top-slicing method. The mine was closed the last half of 1909 because of labor troubles. The ores from the Cumberland-Ely properties were treated at the large concentrating mill at Steptoe along with the Nevada Consolidated production.

The Ely Central mine is opened by 2,452 feet of shaft work and an 1,820-foot tunnel. The Giroux Consolidated Mining Company did 1,000 feet of work in 1909 on the new 5-compartment shaft, which took the place of the Alpha shaft, which caved. The new shaft was sunk in the limestone country rock away from the ore bodies. This company has its own 500-ton concentrating mill, but the smelter was destroyed by fire.

Lead ores carrying values in silver, copper, and gold were shipped to Utah smelters from the Ontario mine at Lane City. The mine is opened by a 300-foot shaft and a 3,000-foot tunnel, and 1,800 feet of new work was done in 1909. A few cars of similar ore were shipped by the Copper Mines Company, which did 530 feet of mine work and 4,645 feet of churn drilling in 1909. The Success Mining Company shipped gold and silver bearing lead ores from its group of 20 claims, 20 miles from McGill.

Development work was being done at the Boston Ely, Ely Resurrection, Ely Gibraltar, Ely Consolidated Copper, and Federal Ely Copper mines in the Robinson district in 1909.

Hamilton and Silverado districts.—There was a reduced metal yield from the Hamilton section west of Ely; only 2 mines made shipments in 1909 as compared with 5 producers in 1908. Silver-lead ores carrying copper were shipped from the Washington mine, 15 miles southeast of Eureka, in the Silverado district.

Osceola district.—Two lode mines and 4 placers yielded $5,977 in gold and $44 in silver. The placer product was valued at $2,505, and represented the results of sampling and prospect work by individuals. At the Black Horse mine a few tons of ore were treated in an arrastre. Ore from the Gem group was treated in a 5-stamp amalgamation mill.

Ward district.—The Nevada United Mines Company, the sole producer at Ward, shipped much less lead ore in 1909 than in 1908. According to the fourth annual printed report the company made 66 shipments of ore from the Paymaster and Ward mines to smelter, representing about 3,000 tons of ore, on which it paid $5.50 per ton railroad freight from Ely to Murray, Utah, and a wagon haulage of $4 per ton from the mine to the railroad at Ely, an 18-mile haul. Owing to the possibility of a railroad being built from Ely to Ward, shipments were discontinued. The lead carbonate ores, which average about 25 per cent in lead and about 5 ounces silver to the ton, carry an excess of 35 per cent in iron and about 7 per cent excess of lime. The company did about 1,628 feet of new work in 1909.

NEW MEXICO.[a]

By Charles W. Henderson.

PRODUCTION.

According to the returns from the mines, the total value of the output of gold, silver, copper, lead, and zinc in New Mexico for the calendar year 1909 was $2,070,368. The gold yield was 11,585.38 fine ounces, valued at $239,491; the silver yield, 397,783 fine ounces, valued at $206,847; the copper, 5,393,146 pounds, valued at $701,109; the lead, 5,029,767 pounds, valued at $216,280; and the zinc, 13,085,945 pounds, valued at $706,641. As compared with the value of 1908, there was in 1909 an increase of $545,277 in the value of the total production. The gold, silver, and copper output decreased, but lead and zinc showed a material increase from operations in Socorro County.

There were 128 producing mines in the Territory in 1909, of which 111 were deep and 17 were placer mines, as compared with 134 producers in 1908, of which 108 were deep and 26 were placer mines.

There were 164,156 short tons of ore sold or treated in 1909, which averaged $12.48 in value per ton, as compared with 135,434 tons, averaging $11.09 per ton in 1908, and with 219,992 tons, averaging $14.64 per ton in 1907. The decrease in tonnage was in copper and zinc ores. The average value per ton in 1909 in gold and silver was $7.99 in siliceous ore; $0.25 in copper ores; $2.84 in lead ores; $4.08 in copper-lead ores; and $0.29 in lead-zinc ores.

During 1909 there were treated in amalgamating or cyaniding mills in New Mexico 32,830 tons of ore, and the bullion saved amounted to $139,035 in gold, at an average value per ton of $4.23, and $88,218 in silver, at an average value per ton of $2.69; the total value in gold and silver being $227,253, at an average of $6.92 per ton. From 78,782 tons treated at mills by concentration only, there were produced 7,554 tons of concentrates, valued at $33,040 in gold, at an average per ton of $4.373, and $58,572 in silver, at an average per ton of $7.753, the total value in gold and silver being $91,612, at an average of $12.13 per ton. The average assay of copper in these concentrates for the Territory was 13.5 per cent; for those concentrates which carried lead, the average was 15.9 per cent; for zinc concentrates the average assay of zinc content was 37.2 per cent.

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[a] Lindgren, Graton, and Gordon, The Ore Deposits of New Mexico: Prof. Paper U. S. Geol. Survey No. 68, 1910.

From the 112,612 tons to all classes of mills, there were produced $172,075 in gold, from both bullion and concentrates, at an average recovery of $1.54 per ton, and $146,790 in silver, at an average recovery of $1.32 per ton, a total recovery in gold and silver of $318,865, at an average of $2.86 per ton in these two metals for all ore milled.

Crude ore shipped to smelters amounted to 52,544 short tons, containing $45,406 in gold, averaging $0.86 per ton; $59,973 in silver, averaging $1.14 per ton, the total value in gold and silver being $105,379, and the average per ton, $2.

Mine production of gold, silver, and associated metals in New Mexico in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold.................fine ounces..	14,452.37	$298,757	11,585.38	$239,491	− 2,866.99	−$59,266
Silver.......................do....	405,044	214,673	397,783	206,847	− 7,261	− 7,826
Copper...................pounds..	6,112,630	806,867	5,393,146	701,109	− 719,484	−105,758
Lead.........................do....	873,763	36,698	5,029,767	216,280	+4,156,004	+179,582
Zinc..........................do....	3,576,516	168,096	13,085,945	706,641	+9,509,429	+538,545
Total	....	1,525,091	....	2,070,368	....	+545,277

The following table shows the production of gold, silver, copper, lead, and zinc in New Mexico in 1909, by counties:

Mine production of gold, silver, copper, lead, and zinc in New Mexico in 1909, by counties.

County.	Tonnage.	Gold.		Silver.	
		Quantity.	Value.	Quantity.	Value.
	Short tons.	*Fine ounces.*		*Fine ounces.*	
Bernalillo, Colfax, San Miguel, and Santa Fe...	2,945	1,011.76	$20,915	2,487	$1,293
Dona Ana....................................	2,816	12.00	248	16,975	8,827
Grant..	89,576	1,829.83	37,826	74,198	38,583
Lincoln..	3,633	1,154.37	23,863	388	202
Luna...	1,163	155.19	3,208	6,916	3,596
Otero..	143	12.43	257	29	15
Sierra...	4,294	505.52	10,450	25,698	13,363
Socorro.......................................	59,586	6,603.14	136,499	269,061	139,912
Unapportioned..............................	....	301.14	6,225	2,031	1,056
Total..	164,156	11,585.38	239,491	397,783	206,847

Mine production of gold, silver, copper, lead, and zinc in New Mexico in 1909, by counties—Continued.

County.	Copper.		Lead.		Zinc.		Total value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
	Pounds.		*Pounds.*		*Pounds.*		
Bernalillo, Colfax, San Miguel, and Santa Fe.	1,116	$145	217,440	$9,350	4,426	$239	$31,942
Dona Ana	10,600	1,378	772,023	33,197			43,650
Grant	5,176,585	672,956	215,070	9,248	203,278	10,977	769,590
Lincoln	700	91	7,977	343			24,499
Luna	1,115	145	682,906	29,365			36,314
Otero	6,354	826					1,098
Sierra	25,838	3,359	49,023	2,108			29,280
Socorro	170,838	22,209	3,085,328	132,669	12,878,241	695,425	1,126,714
Unapportioned							7,281
Total	5,393,146	701,109	5,029,767	216,280	13,085,945	706,641	2,070,368

Tonnage of ore sold or treated, number of deep mines producing, by counties, and average value per ton of ore mined in New Mexico in 1908 and 1909.

County.	Short tons of ore sold or treated.		Number of deep mines producing.	
	1909.	Increase (+) or decrease (−).	1908.	1909.
Bernalillo, Colfax, San Miguel, Santa Fe, and Rio Arriba	2,945	+ 2,488	5	6
Dona Ana	2,816	− 274	5	6
Grant	89,576	+14,322	52	50
Lincoln	3,633	− 766	10	8
Luna	1,163	+ 875	5	9
Otero	143	−22,275	9	3
Sierra	4,294	+ 3,614	10	18
Socorro	59,586	+30,738	12	11
Total	164,156	+28,722	108	111
Average value per ton			$11.09	$12.48

As was noted in the report for 1908, the production of precious and other metals in New Mexico often shows violent changes, and the operations of a single mine sometimes swing the principal production from one metal to another. In 1907, as compared with 1906, there was an increase in copper and a great decrease in zinc. In 1908 there was a decrease in copper, chiefly from the closing of a mine and smelter in Grant County and in Santa Fe County, and there was also a great decrease in the yield of lead in 1908, and a creditable increase in zinc for that year. In 1909 the idleness of a smelter in Otero County was the indirect cause of the idleness of the gold-bearing copper ores of that county, to which the bulk of the gold and copper decrease can be traced; on the other hand, increased operations in Socorro County caused large increases in lead and zinc production for the Territory; activity in the Black Range district, Sierra County near the towns of Chloride, Kingston, and Fluorine, helped swell the production of lead and copper; Luna County contributed an increased yield of gold from the Tres Hermanas district, and of lead from the Cooks Peak and Victorio districts; and Grant County, which produces the larger part of the Territory's copper output, maintained a production only slightly below that of 1908 in all five metals.

GOLD.

The total value of the gold production in New Mexico in 1909 was $239,491, as against $298,757 in 1908, a decrease of $59,266. Socorro County alone produced $136,499, or 57 per cent of the total gold yield. This was almost entirely from siliceous ore. This class of ore furnished in the whole Territory 10,052.35 fine ounces, valued at $207,801, or 87 per cent of the total, Grant, Lincoln, Sierra, and Socorro counties being the main source of the gold-bearing siliceous ore. Copper ores contained 397.80 fine ounces, valued at $8,223, or 3 per cent of the total, Grant and Sierra counties furnishing the gold-bearing copper ores. Lead ores contained 70.50 fine ounces, valued at $1,457, or less than 1 per cent of the total. Placer gold amounted to 1,064.73 fine ounces, valued at $22,010, or 9 per cent of the total.

Source of gold production in New Mexico, by kinds of ore, in 1909, by counties, in fine ounces.

County.	Placer mines.	Deep mines.				Total.
		Dry or siliceous ore.	Copper ores.	Lead ores.	Copper-lead ores.	
Bernalillo, Colfax, San Miguel, and Santa Fe	863.68	126.81		21.27		1,011.76
Dona Ana		7.00		5.00		12.00
Grant	173.38	1,285.00	360.27	11.18		1,829.83
Lincoln	22.83	1,131.54				1,154.37
Luna		141.16		14.03		155.19
Otero	4.84	6.28	1.31			12.43
Sierra		465.30	36.22	4.00		505.52
Socorro		6,588.12		15.02		6,603.14
Unapportioned		301.14				301.14
Total, 1909	1,064.73	10,052 35	397.80	70.50		11,585.38
Total, 1908	1,122.20	9,544.82	3,757.09	26.27	1.99	14,452.37
Increase (+) or decrease (−)	−57.47	+507.53	−3,359.29	+44.23	−1.99	−2,866.99

SILVER.

The silver yield in 1909 amounted to 397,783 fine ounces, valued at $206,847, as compared with 405,044 fine ounces, valued at $214,673, in 1908, a decrease for 1909 of 7,261 fine ounces in quantity and of $7,826 in value. Of the total, Socorro County produced 269,061 fine ounces, or 67.6 per cent, chiefly from siliceous ore from Mogollon district; Grant County, from siliceous, copper, lead, and zinc ores, and placers, furnished 74,198 fine ounces, or 18.6 per cent of the total. The yield of silver from Grant and Socorro counties combined was 86 per cent of the total.

Siliceous ores, chiefly from Grant, Sierra, and Socorro counties, furnished 323,962 fine ounces, or 81 per cent of the total; copper ores, chiefly from Grant County, 23,318 ounces, or 6 per cent; lead ores, chiefly from Dona Ana, Grant, Luna, Sierra, and Socorro counties, furnished 34,463 ounces, or 9 per cent; and lead-zinc ores, 15,684 ounces, or 4 per cent of the total.

Source of silver production in New Mexico, by kinds of ore, in 1909, by counties, in fine ounces.

County.	Placer mines.	Deep mines.						Total.
		Dry or siliceous ore.	Copper ores.	Lead ores.	Zinc ores.	Copper-lead ores.	Lead zinc ores.	
Bernalillo, Colfax, San Miguel, and Santa Fe.	106	92		2,289				2,487
Dona Ana		10		16,771		194		16,975
Grant	50	46,191	22,884	5,073				74,198
Lincoln	4	342		42				388
Luna		139		6,777				6,916
Otero	2	27						29
Sierra		23,796	371	1,531				25,698
Socorro		251,334	63	1,980			15,684	269,061
Unapportioned		2,031						2,031
Total, 1909	162	323,962	23,318	34,463		194	15,684	397,783
Total, 1908	153	364,335	24,768	14,870		918		405,044
Increase (+) or decrease (−)	+9	−40,373	−1,450	+19,593		−724	+15,684	−7,261

COPPER.

The copper output of New Mexico decreased from 6,112,630 pounds, valued at $806,867, in 1908 to 5,393,146 pounds, valued at $701,109, in 1909, a decrease of 719,484 pounds in quantity and of $105,758 in value. This decrease was chiefly from Grant and Otero counties. Dona Ana County copper output also decreased, as compared with the small output of 1908, which was a great decrease as compared with the yield in 1907. The only increase of note was that of Socorro County, 151,376 pounds. The county output of copper in 1909 failed, however, to equal that of 1907.

LEAD.

The lead production increased from 873,763 pounds, valued at $36,698, in 1908 to 5,029,767 pounds, valued at $216,280, in 1909, an increase of 4,156,004 pounds in quantity and of $179,582 in value. The production in 1907 was 3,809,881 pounds, valued at $201,924. In 1909 notable increases in lead production were made in Socorro, Luna, Dona Ana, and Santa Fe counties. Smaller increases were made in Lincoln and Sierra counties. Grant County showed a small decrease.

ZINC.

Zinc was produced in 1909 in Grant, Santa Fe, and Socorro counties. Grant County produced 203,278 pounds, a decrease of 47,792 pounds; Socorro County produced 12,878,241 pounds, an increase of 9,552,795 pounds; and the yield of the zinc mines at Magdalena, in Socorro County, in 1909 was 98 per cent of the total. The Germany Mining Company, the Ozark Smelting and Mining Company, and the Tri-Bullion Smelting and Development Company were principal operators in 1909.

SMELTERS.

The El Paso, Tex., smelter and the Copper Queen smelter, at Douglas, Ariz., continued to handle the bulk of the smelting ores of New Mexico. Some lead and zinc ore was also shipped to Pueblo, Colo., and some copper ore to the Shannon smelter, Clifton, Ariz.

All of the smelters within the Territory were idle. These are the Comanche, at Silver City, Grant County; the Oro Grande, at Oro Grande, Otero County; the Santa Fe, at San Pedro, Santa Fe County; and the lead smelter of the National Mining and Smelting Company, at Deming, Luna County.

Subdivision of tonnage of ore sold or treated in New Mexico in 1909, by counties, in short tons.

County.	Siliceous or dry ore.	Copper ores.	Lead ores.	Zinc ores.	Copper-lead ores.	Lead-zinc ores.	Total.
Bernalillo, Colfax, San Miguel and Santa Fe	119	....	2,826	....	....	....	2,945
Dona Ana	2,063	....	730	....	23	....	2,816
Grant	7,884	81,081	416	193	2	....	89,576
Lincoln	3,619	....	14	....	....	....	3,633
Luna	285	....	878	....	....	....	1,163
Otero	123	20	....	....	....	....	143
Sierra	4,120	39	135	....	....	....	4,294
Socorro	28,868	4	1,821	....	....	28,893	59,586
Total, 1909	47,081	81,144	6,820	193	25	28,893	164,156
Total, 1908	31,642	93,359	3,859	6,554	20	....	135,434
Increase (+) or decrease (−)	+15,439	−12,215	+2,961	−6,361	+5	+28,893	+28,722
Average recovered value per ton in gold and silver	$7.99	$0.25	$2.84	....	$4.08	$0.29	$2.58

REVIEW BY COUNTIES.

BERNALILLO COUNTY.

The Sandias Mining and Milling Company, in the Soda Springs district, shipped a small tonnage of lead ore to the smelter in 1909. The development on this mine consists of a 60-foot incline shaft. The production of this county has been combined with Colfax, San Miguel, and Santa Fe counties to avoid disclosing individual returns.

COLFAX COUNTY.

In Colfax County is the principal gold placer district in New Mexico. This district, near Elizabethtown and Baldy, produced $16,037 in placer gold in 1909, as compared with $11,274 in 1908. Ore was shipped from the Ajax deep mine, near Elizabethtown.

DONA ANA COUNTY.

Mine production of gold, silver, and associated metals in Dona Ana County, New Mex., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold..........fine ounces	....	....	12.00	$248	+ 12.00	+ $248
Silver..........do	9,283	$4,920	16,975	8,827	+ 7,692	+ 3,907
Copper..........pounds	21,150	2,792	10,600	1,378	− 10,550	− 1,414
Lead..........do	379,697	15,948	772,023	33,197	+392,326	+17,249
Total	....	23,660	....	43,650	....	+19,990

In value of total output this county moved from seventh in rank in 1908 to third in 1909. The total output was from the Organ district alone, near the towns of Organ and Kent. There was an increase in the quantity of gold, silver, and lead produced, and a decrease in that of copper, as compared with the small production of that metal in 1908. There were 6 producing mines in the district. The total tonnage was 2,816 tons of smelting ore.

The Memphis Copper Company, a large producer of copper in 1907, a smaller producer in 1908, was idle in 1909. Up to the year 1908, this mine had been worked by lessees for the last thirty-five years. Crude lead ore, from the Bennett-Stephenson mine, was shipped to the El Paso smelter. The 250-ton concentrating plant of this company was not operated. Other producers were, the Big Tree group, the McKinney, and the Victoria mines. The Torpedo mine was idle.

GRANT COUNTY.

Mine production of gold, silver, and associated metals in Grant County, New Mex., in 1908 and 1909.

Metal.	1908.		1909.		Decrease.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold........fine ounces..	2,209.87	$45,682	1,829.83	$37,826	380.04	$7,856
Silver........do....	95,477	50,603	74,198	38,583	21,279	12,020
Copper........pounds..	5,242,767	692,045	5,176,585	672,956	66,182	19,089
Lead........do....	244,589	10,273	215,070	9,248	29,519	1,025
Zinc........do....	251,070	11,800	203,278	10,977	47,792	823
Total........	....	810,403	....	769,590	....	40,813

Grant County again ranked first in point of tonnage sold or treated, but gave way to Socorro County in total value of product. The production of each of the metals showed a small decrease. In production of copper Grant County ranked first, with 96 per cent of the total output for the State. In production of gold, silver, lead, and zinc, Grant County again ranked second to Socorro County. Grant and Socorro counties produced the great bulk of the zinc for the State, a nominal output being produced in Santa Fe County. There were 50 producing deep mines in Grant County in 1909, as compared with 52 in 1908.

The yield from placers in the Pinos Altos district showed a slight increase.

Siliceous and dry ores (carrying copper under 4½ per cent), amounted to 7,884 short tons, as compared with 4,327 tons in 1908, and 21,832 tons in 1907. Copper ores formed the bulk of the tonnage, with 81,081 tons, an increase of 10,936 tons in this class of ore. The remaining 611 tons were lead, copper-lead, and zinc ores.

As in 1908, the greater part of the ore mined went to concentrating mills. From the 68,571 tons concentrated were produced 6,105 tons of concentrates (at a ratio of 11 to 1), the average assay per ton of which was 13.79 per cent in copper, the content in gold and silver being negligible.

There were 21,004 tons of ore sent direct to the smelters, the average assay per ton of which was 0.077 ounce in gold, 3.60 ounces in silver, 7.73 per cent copper, and 1.18 per cent lead.

Apache district.—The Anderson-Apache Copper Company was the only shipper from this district in 1909.

Burro Mountain district.—The chief ore of this camp, which lies southwest of Silver City, near Leopold and Tyrone, is copper. There was an increase in the output of this metal in 1909. The Burro Mountain Copper Company continued development work during the year and ran the 300-ton concentrating mill part of the year. Other producers were the Woodward and the J. F. Jefford mines. The Savanna Copper Company's mines were developed, but no ore was marketed. The Chemung Copper Company did much development work. The shafts on this company's properties are down 532 feet, 722 feet, and 421 feet, respectively. The Mangus Copper Company prospected with churn drills.

Central district.—The Central district, embracing the towns of Fierro, Bayard, Hanover, and Santa Rita, was the most productive district in Grant County, though the yield of copper fell from 3,994,502 pounds in 1908 to 3,348,808 pounds in 1909. There were 9 producing mines in this district.

The Santa Rita mines and 100-ton concentrating plant were operated by lessees and by the Chino Copper Company. This company acquired a large acreage of mineral lands in 1909, and will mine part by steam shovel, part by the caving system, and part by stoping. Systematic prospecting was done by the company, using 8 churn drills.

Shipments of copper ore to smelters were also made from the Clearwater, the Hanover, and the Philadelphia mines. Lead ore was shipped from the Lucky Bill mine. Zinc ore was shipped from the Pewabic and Black Jack property, and from the New Mexico mine.

Chloride Flat district.—The ores of this district contain chiefly silver, copper, and lead. The total value of the production was one-fourth of that in 1908. The Bohemian and the Baltic mines were the only two producers.

Eureka district (including Sylvanite).[a]—This district embraces the little Hachita Range, in southwestern Grant County. Sylvanite is on the west side of the mountains and about 12 miles due southwest of Hachita. The Eureka district, as a whole, showed a decrease in total value of output. Sylvanite, alone, produced less gold, silver, and copper in 1909, but added lead to its production in that year. The total value of ore shipped from Sylvanite showed a decrease. The producing mines at Sylvanite were the Ridgewood, the Gold Hill, the Monte Cristo (or Pearl), and the Buchanan group. Development work in 1909 was reported on the Ridgewood, the Gold Hill, and the Monte Cristo group. Outside of Sylvanite proper, there were two other producers in the Eureka district, the Daisy mine and the Vicraywin Mining Company.

Fleming district.—Some small shipments of ore were made from this district.

Granite Gap district.—There were no shipments from this district in 1909.

Lordsburg district (including Pyramid and Virginia or Shakespeare districts).—The production of this district in 1909 was 1,256.93 fine ounces of gold, valued at $25,983; 50,154 fine ounces of silver, valued at $26,080; 589,969 pounds of copper, valued at $76,696; and 8,862 pounds of lead, valued at $381; a total value of $129,140, as compared with $50,534 in 1908.

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[a] Hill, J. M. Prof. Paper U. S. Geol. Survey No. 68, 1910, pp. 338–343.

The Lordsburg mining district is 3 to 8 miles south-southwest of the town of that name, in central Grant County. Embraced in this district are two camps, Pyramid, at the south end, and Shakespeare, or Virginia, at the north. Producing mines in 1909 were the Bonnie, the Dundee, the Eighty-Five, the Robert E. Lee, the Nellie Bly and Cobre Negro, the Superior, and the Goodsight.

Pinos Altos district.—This district, in 1909, from both placers and deep mines, made a production of $7,207, in total value, as compared with $19,488 in 1908. The placer yield was greater in 1909, but the deep mine yield decreased heavily. Ores carrying gold, silver, lead, and copper were shipped from 3 mines, the Arizona, the Copper Bell, and the Old Timer.

Red Hill district.—This district is situated near the southwestern corner of New Mexico, due southwest of Hachita. Lead ore, carrying gold, silver, and copper was shipped to El Paso, Tex., from the Red Hill mine.

Steeple Rock district.—Steeple Rock is in the northwestern part of the county, and is reached from Duncan, Ariz. There was a considerably decreased yield from this district in 1909. Small shipments were made from the Laura, the Overlook, and the Shamrock mines.

Steins (or Kimball) district.—Siliceous ore, carrying gold and silver, was shipped from the Volcano mine, in this district.

White Signal district.—From this district, near Silver City, copper ore from the Tulloch and the Paddy Ford mines was shipped to smelters in 1909.

Whitewater district.—Small shipments were made in 1909 from the district adjoining the town of Whitewater.

LINCOLN COUNTY.[a]

The total value of the production in 1909 in Lincoln County was $24,499, or $8,271 less than in 1908, there being a decrease in output of gold, silver, and copper in the White Oaks and the Cedar Creek districts, and an increase in production of lead from the Nogal and the Gallinas districts. There were 8 producing deep mines, and 1 placer, the latter in the Jicarilla district. The placer production decreased in 1909. The tonnage from deep mines sold or treated was 3,633 short tons in 1909, as compared with 4,399 tons in 1908.

Cedar Creek district.—This district, near the town of Alto, south of Bonito, might be included in the Bonito or Parsons subdistrict, a part of the Nogal[b] district. One small shipment was reported.

Gallinas district.[b]—A small shipment of lead ore was made in 1909.

Jicarilla district.[c]—A small production was made in 1909 in gold and silver from placers and from deep mines.

Nogal district (including Bonito).—This district embraces the towns of Nogal, Parsons, and Bonito. The Vera Cruz Mining Company treated its ore in a 200-ton cyaniding plant.

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[a] Graton, L. C. Prof. Paper U. S. Geol. Survey No. 68, 1910, pp. 175-184.

[b] Op. cit., p. 176.

[c] Op. cit., p. 183.

White Oaks district.—The production from White Oaks district in 1909 was a little less than in 1908. The Wild Cat Leasing Company, on the North and South Homestake mines, was the chief producer in the district. The 50-ton amalgamating mill of the Old Abe Mining Company was operated on ore from the Old Abe mine. The shaft on this property was sunk to 1,505 feet.

LUNA COUNTY.

The total value of the production of Luna County in 1909 was $36,314, as compared with $6,713 in 1908. The output of lead, the principal metal of the county, was 682,906 pounds, a material increase.

Cooks Peak district.—There were 5 shippers in 1909, as compared with 3 in 1907. The greater part of the output came from the operations of the Cooks Peak Mining Company, on the Summit mine, and of lessees on the American Smelting and Refining Company's claims, the Desdemona, Inez, Monte Cristo, and Othello. Ore was also shipped from the Constant mine and from the Contention and Webster group.

Fremont district.—The International mine, located in the corner of Luna County, Grant County, and Mexico, was operated during the year.

Victorio district.—Lead ore from this district was shipped in 1909 from the Helen, the Last Chance, and the Rambler mines.

MORA COUNTY.

There was no production in Mora County in 1909.

OTERO COUNTY.

The total value of the production from 3 deep mines and 1 placer in Otero County in 1909 was $1,098, a decrease, as compared with $132,454 in 1908.

Highrolls district.—In this district, near Mountain Park, there was no production.

Silver Hill district.—The smelter and mines of the Oro Grande Smelting Company were not operated in 1909. Shippers from this district were the Delusion, the Cuprite, and the Golden Gem and Alice group. The First National Mining Company operated the Colden Gate and the Duplex placers.

Tularosa district.—The Tularosa Copper Company continued development work in 1909. This company expects to ship copper ore and concentrates in 1910.

RIO ARRIBA COUNTY.

There was no production from this county in 1909.

SAN MIGUEL COUNTY.

There was a small output from the Tecolote district, in this county, in 1909.

SANTA FE COUNTY.

This county produced in 1909 all five metals, the total value of which was $13,445, an increase over the small yield of $2,034 in 1908. There was an increase in gold production from both the Los Cerillos and the New Placers (or Golden) placer mines. The Boston Cerillos Mines Company, operating the Cash Entry mine at Los Cerillos, and the San Lazarus Mines Company, at San Pedro, were the two operators of deep mines in the county.

SIERRA COUNTY.

In 1909, the total value of the mineral production in Sierra County showed an increase of $4,756, as compared with the value of 1908. There was an increase in the yield of silver, copper, and lead, but a decrease in the output of gold.

Black Range district.—This district includes the subdistricts of Chloride, Fluorine, and Kingston. There was an increase in the output of gold, sliver, and copper from the district, chiefly from the Chloride camp.

Bromide (or Lake Valley) district.—There were no producing placers in this district in 1909, as against a considerable output in 1908, and the output from deep mines also decreased in gold and copper. In yield of silver and lead, there was an increase. The operating companies were the Good Luck Mining Company, the D. S. Miller Company on the Log Cabin mine, the Moffett Mining and Milling Company, and the Monarch Development and Reduction Company.

Hermosa district.[a]—This district, near the town of Hermosa, showed a material increase in 1909 from the output of the Ocean Wave mine.

Las Animas district.—This district, near Hillsboro, produces most of the gold of the county. There was a decrease in production of gold and silver, but an increase in copper and lead output in 1909. The principal property of the district was the Wicks Gulch mine, operated by the Sigma Construction and Development Company. Other producers were the Bonanza, the Mountain King, the Ready Pay, and the San Antonio mines.

Pittsburg district.—This district lies near the town of Las Palomas. The Victorio Chief Mining and Smelting Company shipped copper ore from the Fidelity group of mines.

SOCORRO COUNTY.

Mine production of gold, silver, and associated metals in Socorro County, N. Mex., in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold.....fine ounces..	6,622.05	$136,890	6,603.14	$136,499	− 18.91	− $391
Silver.....do....	280,091	148,448	269,061	139,912	− 11,030	− 8,536
Copper.....pounds..	19,462	2,569	170,838	22,209	+ 151,376	+ 19,640
Lead.....do....	16,073	675	3,085,328	132,669	+3,069,255	+131,994
Zinc.....do....	3,325,446	156,296	12,878,241	695,425	+9,552,795	+539,129
Total.....	.....	444,878	.....	1,126,714	.....	+681,836

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[a] This district has heretofore been called Las Palomas, which is confusing, in face of the existence of a town of that name in another district.

Socorro County in 1909 ranked first in total value of output, making a production in all five metals. There was a small decrease in gold and silver output, but a marked increase in the yield of copper, lead, and zinc. The zinc production was 12,878,241 pounds, valued at $695,425, an increase of 9,552,795 pounds in quantity and of $539,129 in value.

Cooney (or Mogollon) district.—In 1909 there was a slight decrease in gold and silver production from this district, which is the source of the greater part of the precious metal output for the county. As in 1908, there was no copper from this district.

The Ernestine Mining Company, operating the Last Chance mine, was (as it has been for years) the largest producer of precious metals in New Mexico. The reduction plant at the mine consists of a 20-stamp plate-amalgamation mill, with concentrators and cyanide plant, with a total capacity of 60 tons per day. The workings consist of an incline shaft 725 feet deep and a tunnel 2,350 feet long. The Socorro Mines Company ran its 120-ton concentration and cyanide plant on ore from its mines, chief of which are the Little Fannie and the Champion. The Enterprise Mining Company operated its 100-ton cyanide plant built in 1908.

Magdalena district.—This district is in the central-western part of Socorro County. The chief metal of the district was zinc, but considerable lead was produced, and also some copper, silver, and a little gold. The production of zinc in 1909 was 12,878,241 pounds, valued at $695,425, as compared with 3,325,446 pounds, valued at $156,296, in 1908, and with 676,356 pounds, valued at $39,905, in 1907.

There were 7 producing mines in this camp in 1909. The Ozark Smelting and Mining Company, owning the Graphic, and the Tri-Bullion Smelting and Development Company, which, in conjunction with lessees, operated the Kelly mine, were the principal operators. There was an output also from the Hardscrabble group, the Germany group, the Key group, and the Old Soldier mine.

Rosedale district.—This camp is 30 miles south of Magdalena. The Rosedale Mining and Milling Company made an increased output in bullion and cyanide precipitates. There is a 50-ton mill on this property.

TAOS COUNTY.

Development work only was reported by mines in the Red River district and at Twining.

OREGON.

By Charles G. Yale.

PRODUCTION.

For the calendar year 1909 operators of 162 mines, of which 66 were deep and 96 were placers, reported production from Oregon. The number of deep mines is the same as in 1908, but there was a decrease of 77 productive placers in 1909. The aggregate output of these mines was valued at $827,001. Of the total output the gold yield was 37,827.51 fine ounces, valued at $781,964; the silver yield was 27,827 ounces, valued at $14,470; the copper, 235,000 pounds, valued at $30,550; and the lead, 400 pounds, valued at $17. In

1908 the total value of all the metals produced in Oregon was $926,737, so that the decrease in value of output for 1909 was $99,736. The total quantity of ore mined and treated in 1909 was 59,251 short tons, an increase of 8,567 tons. The siliceous ores amounted to 57,634 tons in 1909, an increase of 9,083 tons as compared with the production of 1908; the copper ores, amounting to 1,647 tons, decreased 486 tons. The average value of siliceous ore per ton in gold and silver in 1909 was $9.87, as compared with $12.49 in 1908, which in part accounts for the falling off in total gold yield. The copper ore smelted in 1909 yielded an average value of $2.92 per ton in gold or silver. The average recovered value per ton of all metals was $9.87 in the siliceous ores in 1909, as compared with $12.50 in 1908.

There were treated in 1909 at gold and silver mills 55,160 tons of ore, containing $498,964 in gold and $5,026 in silver. In milling the ore, $331,144 in gold and $3,317 in silver were recovered by ordinary plate amalgamation, the average being $6 in gold and 6 cents in silver per ton. The concentrates saved from all concentrating ore were 1,975 tons in quantity, valued at $167,820 in gold and $1,709 in silver, or an average of $84.97 in gold and 86 cents in silver per ton. The average total extraction per ton of crude ore in gold and silver mills, both by amalgamation and in the concentrates, was $9.04 in gold and 9 cents in silver. Crude siliceous ore shipped to smelters amounted to 474 tons, valued at $54,999 in gold and $7,733 in silver, an average per ton of $116 in gold and $16.31 in silver. This also yielded 400 pounds of lead, valued at $17. In addition there were 1,647 tons of copper ore smelted, which yielded $4,700 in gold, 227 ounces of silver, and 235,000 pounds of copper, valued at $30,550. Crude ore shipped to concentrating mills yielded $1,000 in gold and $1 in silver. With the siliceous ore is included 1,900 tons of tailings.

The statement of production of 1908 and 1909, showing increase and decrease of gold, silver, and associated metals in Oregon, valued at each year's commercial prices, is as follows:

Mine production of gold, silver, and associated metals in Oregon in 1908 and 1909.

	Gold.		Silver.		Copper.		Lead.		Total value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
	Fine ounces.		*Fine ounces.*		*Pounds.*		*Pounds.*		
1908	41,848.05	$865,076	43,602	$23,109	291,377	$38,462	2,138	$90	$926,737
1909	37,827.51	781,964	27,827	14,470	235,000	30,550	400	17	827,001
Decrease	4,020.54	83,112	15,775	8,639	56,377	7,912	1,738	73	99,736

GOLD.

The total output of gold in Oregon in 1909 was 37,827.51 fine ounces, valued at $781,964, a decrease of 4,020.54 fine ounces in quantity and of $83,112 in value, as compared with the output of 1908. The largest yield of gold from one county, valued at $417,538 in 1909, came, as usual, from Baker County, although it was $90,391 less than that in 1908. The next county in rank of gold production was Josephine, followed by Jackson, Malheur, Grant, Lane, and Curry, in the order named. The largest production from deep mines was from Baker County, and of placer mines from Josephine County. The most productive quartz mine in the State was in Baker County, and the most productive placer (dredge) was in Jackson County. Sixty-five quartz mines produced gold in 1909, 1 more than in 1908. Productive placers numbered 96 in 1909, as compared with 173 in 1908. The placers in 1909 yielded $221,318 in gold, as compared with $272,593 in 1908, a decrease of $51,275. The hydraulic mines in 1909 yielded $157,363 in gold, which is $23,619 less than in 1908; and the surface placers, dredges, and drift mines combined yielded $63,955, which is $27,656 less than in 1908. There were in the State 62 productive hydraulic mines, 10 drift mines, 2 dredges, and 22 surface placers or sluicing mines.

The gold production from different kinds of mines, by counties, for 1909 is given in the following table:

Source of gold product in Oregon, by kinds of ore, in 1909, by counties, in fine ounces.

County.	Placers.	Deep mines.			Grand total.
		Siliceous ores.	Copper ore.	Total.	
Baker	796.74	19,401.66		19,401.66	20,198.40
Coos	15.09	5.81		5.81	20.90
Crook		48.38		48.38	48.38
Curry	367.26	50.31		50.31	417.57
Douglas	4.98	81.80		81.80	86.78
Grant	531.45	1,467.79		1,467.79	1,999.24
Harney	39.43				39.43
Jackson	3,415.85	1,432.19		1,432.19	4.848.04
Josephine	5,158.37	1,822.00	227.36	2,049.36	6,980.37
Lane		685.57		685.57	685.57
Malheur	150.45	1,898.38		1,898.38	2,048.83
Wheeler	226.64				226.64
Total	10,706.26	26,893.89	227.36	27,121.25	37,827.51
Decrease	2,480.42	1,483.75	56.37	1,540.12	4,020.54

The following table shows the source of placer gold in Oregon, by counties, in 1909:

Source of placer gold in Oregon in 1909, by counties.

County.	Hydraulic mines.	Surface placers, drift, and dredging.	Total value.
Baker	$8,660	$7,810	$16,470
Coos	102	210	312
Curry	617	6,975	7,592
Douglas	103		103
Grant	6,451	4,535	10,986
Harney		815	815
Jackson	27,842	42,770	70,612
Josephine	105,793	840	106,633
Malheur	3,110		3,110
Wheeler	4,685		4,685
Total	157,363	63,955	221,318
Decrease	23,619	27,656	51,275

SILVER.

The yield in silver in Oregon in 1909 aggregated 27,600 fine ounces, valued at $14,352, a decrease of 16,002 ounces in quantity and of $8,757 in value, as compared with the production of 1908. Baker County made the largest silver output, 19,514 fine ounces, valued at $10,147, which was more than tenfold that of any other county in the State, only one of the others having reached as high in product as 1,900 fine ounces. The placer mines of the State yielded 2,054 ounces of silver in 1909, which is 3,797 less than was shown for 1908. The quartz mines yielded 25,546 ounces, all from siliceous ores, which is 11,918 ounces less than was derived from the siliceous ores in 1908. Only 227 fine ounces of silver was reported from the copper ores smelted.

The source of silver, by kinds of ore and by counties, in 1909, is shown in the following table:

Source of silver product in Oregon, by kinds of ore, in 1909, by counties, in fine ounces.

County.	Placers.	Deep mines.			Grand total.
		Siliceous ores.	Copper ore.	Total.	
Baker	183	19,331		19,331	19,514
Coos	6	4		4	10
Crook		2		2	2
Curry	48	15		15	63
Douglas		27		27	27
Grant	131	1,563		1,563	1,694
Harney	10				10
Jackson	927	1,011		1,011	1,938
Josephine	663	754	227	981	1,644
Lane		1,335		1,335	1,335
Malheur	36	1,504		1,504	1,540
Wheeler	50				50
Total	2,054	25,546	227	25,773	27,827
Decrease	3,797	11,918	60	11,978	15,775

COPPER AND LEAD.

The copper output of Oregon in 1909 was 235,000 pounds, valued at $30,550, a decrease in quantity of 56,377 pounds and in value of $7,912. This copper was entirely derived from Josephine County, and $4,700 in gold and 227 fine ounces of silver were recovered with it. A merely nominal quantity of lead was obtained from Jackson County.

MINING INDUSTRY IN OREGON IN 1909.

Southwestern and northeastern Oregon form two distinct mining regions, which differ in character of deposits and ores. The mines in southwestern Oregon form an extension of the California gold belt. The counties in this region are Benton, Coos, Curry, Douglas, Jackson, Josephine, and Lane. Benton County made no production in 1909, but the others named made a combined gold production of $274,245, which is an increase of $23,601 over the output of 1908. The production of placer gold from this region in 1909 was valued at $185,252, or a decrease of $8,232 as compared with the output of

1908. The gold production from the deep mines was $88,993, which was an increase of $31,833 over the output of 1908. The silver production in southwestern Oregon in 1909 was 5,017 fine ounces.

Northeastern Oregon comprises Baker, Crook, Grant, Harney, Malheur, Umatilla, Union, Wallowa, and Wheeler counties, among which is the most productive county in the the State. The combined gold yield of these counties in 1909, omitting Wallowa and Umatilla, with no output, was $507,719, a decrease of $106,713. The placer gold yield was $36,066 in 1909, or $43,043 less than in 1908. The lode mines yielded $471,653 in gold, a decrease of $63,670. The silver product of northeastern Oregon was 22,810 fine ounces in 1909.

The following table shows the production of gold, silver, copper, and lead in Oregon in 1909, by counties:

Mine production of gold, silver, copper, and lead in Oregon in 1909, by counties.

	Gold.		Silver.		Copper.		Lead.		Total value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
	Fine ounces.		*Fine ounces.*		*Pounds.*		*Pounds.*		
Baker	20,198.40	$417,538	19,514	$10,147					$427,685
Coos	20.90	432	10	5					437
Crook	48.38	1,000	2	1					1,001
Curry	417.57	8,632	63	33					8,665
Douglas	86.78	1,794	27	14					1,808
Grant	1,999.24	41,328	1,694	881					42,209
Harney	39.43	815	10	5					820
Jackson	4,848.04	100,218	1,938	1,008			400	$17	101,243
Josephine	7,207.73	148,997	1,644	855	235,000	$30,550			180,402
Lane	685.57	14,172	1,335	694					14,866
Malheur	2,048.83	42,353	1,540	801					43,154
Wheeler	226.64	4,685	50	26					4,711
Total	37,827.54	781,964	27,827	14,470	235,000	30,550	400	17	827,001

The following table shows, by counties, the tonnage of ore, concentrates, and tailings in Oregon in 1909:

Tonnage of ore, concentrates, and old tailings in Oregon in 1909, by counties, in short tons.

County.	Total tons of ore sold or treated.	Increase (+) or decrease (−) compared with 1908.	Concentrates produced.		Old tailings treated.
			Quantity.	Value in gold and silver.	Quantity
Baker	32,521	−5,892	1,718	$152,172	
Coos	3				
Crook	100	+ 100	14	1,001	
Curry	901	+ 891			900
Douglas	241	+ 121			
Grant	7,058	+2,807	40	724	
Jackson	5,329	+2,036	80	9,000	
Josephine	5,962	+1,395			
Lane	3,212	+3,186			1,000
Malheur	3,954	+3,954	123	6,632	
Union		− 1			
Total	59,281	+8,597	1,975	169,529	1,900
Average value per ton of ore	$10.12	−$2.73			

The total tonnage, by kinds of ore sold or treated, in each county in Oregon in 1909 is shown in the following table:

Subdivision of tonnage of ore sold or treated in Oregon in 1909, by counties, in short tons.

County.	Siliceous ores.	Copper ores.	Total.
Baker	32,521		32,521
Coos	3		3
Crook	100		100
Curry	901		901
Douglas	241		241
Grant	7,058		7,058
Jackson	5,329		5,329
Josephine	4,315	1,647	5,962
Lane	3,212		3,212
Malheur	3,954		3,954
Total	57,634	1,647	59,281
Increase (+) or decrease (−)	+9,083	−486	+8,597
Average value per ton in gold and silver	$9.87		$9.63
Average recovered value per ton in all metals	$9.87	$18.55	$10.12

The following table gives the number of mines, classified according to their chief product, in the counties of Oregon in 1909:

Number of mines, classified by chief product, in Oregon in 1909, by counties.

County.	Gold placer mines.					Deep mines.			Total mines reporting product.
	Hydraulic.	Drift.	Dredging.	Sluicing.	Total.	Gold.	Copper.	Total.	
Baker	10	6		6	22	20		20	42
Coos	1			1	2	1		1	3
Crook						1		1	1
Curry	3			6	9	2		2	11
Douglas	1				1	3		3	4
Grant	6	3		2	11	16		16	27
Harney				3	3				3
Jackson	10		2	1	13	5		5	18
Josephine	25	1		3	29	9	1	10	39
Lane						3		3	3
Malheur	3				3	5		5	8
Wheeler	3				3				3
Total	62	10	2	22	96	65	1	66	162

PRODUCTION BY COUNTIES.

BAKER COUNTY.

There was a material decrease in value of total output of gold and silver in Baker County in 1909. The yield of gold, valued at $417,538 in 1909, was $90,391 less than in 1908. The silver product, 19,514 fine ounces in 1909, was 2,019 ounces in quantity and $874 in value greater than in 1908. The total falling off in value of the output of gold and silver in the county in 1909 was $89,517. The decrease in value of gold output was 18 per cent and in that of silver 9 per cent. There were 42 producing mines in the county in 1909, as compared with 50 in 1908. The placers numbered 22, of which 10 were hydraulic, 6 drift, and 6 sluicing mines. These placers combined yielded $16,470 in gold and $95 in silver in 1909. The total number of deep mines from which product was reported was 20, and their output was 32,521 tons of siliceous ore in 1909, or 5,892 tons less than in 1908. The gold yield of this ore was valued at $401,068, and the silver yield was 19,331 fine ounces, valued at $10,052. The average value of the ores per ton was $12.64 in gold and 31 cents in silver, a total of $12.95 per ton in 1909, as compared with $12.46 per ton in gold and silver in 1908. From the 32,521 tons of siliceous ore there were derived 1,718 tons of concentrates, yielding $151,081 in gold and $1,091 in silver, a total of $152,172. The average value of these concentrates was $88.58 per ton. There was a larger tonnage of concentrates in 1909 than in 1908, but the average value per ton was $18.68 less in 1909 than in 1908.

Baker City district.—The mines at Baker, Virtue, Pocahontas, and Rock Creek are considered as included in this district, the number of producing mines being 6 deep mines and 4 placers, the latter small sluicing properties. These placers yielded only $703 in 1909. The deep mines produced 425 tons of ore, yielding $22,760 in gold and $7,212 in silver. The most productive deep mine was that of the Highland Gold Mines Company, which ships all its ores to a smelter.

Cracker Creek district.—This district includes the mines at Bourne and Sumpter, among them the highly productive mines of the Columbia Gold Mining Company. The deep mines of the district in 1909 produced 17,211 tons of ore, yielding $158,619 in gold and $372 in silver. One hydraulic placer mine was worked near Sumpter.

Cornucopia district.—There were 3 producing deep mines in this district, having a combined output of 11,776 tons of ore, valued at $139,519 in gold and $1,973 in silver. The most important of those was the property of the Cornucopia Mines Company of Oregon, which is provided with a 20-stamp mill and concentrators. The Queen of the West Mines Company has a 10-stamp mill with concentrators. The other deep mine in the district is owned by the Stampede Mining Company.

Rye Valley and Mormon Basin district.—In these districts, lying close together, there are 2 placer mines and 1 deep mine, which together yielded $72,999 in gold and $459 in silver in 1909. The most productive property was that of the Commercial Mining Company which is equipped with a 50-ton mill and concentrators.

Other districts.—At Bridgeport are 3 producing hydraulic mines, 1 drift, and 1 sluicing mine, the combined output of which in 1909 was $4,994 in gold and $19 in silver. At Connor Creek there is only 1 productive quartz mine. At Durkee are 2 deep mines and 1 placer, which had a combined output of $974 in gold and $5 in silver. At Geiser the Phoenix Mining Company, operates a quartz property, the only productive mine. There are 4 drift mines and 1 hydraulic at Hereford, the combined output of which in 1909 was $6,302 in gold and $30 in silver. There is 1 quartz and 1 placer mine at Richland, each with merely a nominal output for 1909. There are 2 producing mines at Weatherby, 1 deep mine and 1 placer, which had a combined output of $807 in gold and $7 in silver in 1909.

COOS, CROOK, AND CURRY COUNTIES.

In Coos County 1 deep mine at Myrtle Point and 2 placers at Bullard and Sixes River yielded altogether only $432 in gold and $5 in silver. Only 1 deep mine in Crook County reported a product, as shown in the tables printed herewith. In Curry County the 2 deep mines at Harbor and Illahe produced 901 tons of ore, yielding $1,040 in gold and $8 in silver. The placer mines in the county numbered 9, of which 3 were hydraulic and the others mainly ocean-beach placers. The combined output of these placers at Eckley, Corbin, Denmark, Gold Beach, Marial, and near Port Orford, was valued at $7,592 in gold and $25 in silver.

DOUGLAS COUNTY.

Three deep mines in Douglas County produced 241 tons of ore, yielding $1,691 in gold and $14 in silver. These are in Wolf Creek and Myrtle Creek districts. There is also 1 placer at Ollala, with a nominal output.

GRANT AND HARNEY COUNTIES.

In 1909 Grant County produced 1,999.24 fine ounces in gold, valued at $41,328, and 1,694 ounces of silver, valued at $881. The 16 deep mines in this county producing in 1909 were at Austin, Beach Creek, Granite, Prairie City, Red Boy, and Susanville. Their production of ore in 1909 was 7,058 tons, yielding $30,342 in gold and $813 in silver. The most productive of those mines were those of the Cougar Gold Mining Company, at Granite, and the Red Boy Mines Company, at Red Boy. With the exception of a few tons shipped to a smelter all this ore was milled. The largest producer at Granite in 1908 made a comparatively small output in 1909, which accounts for the material decrease in silver yield in this county for the year. There were 11 productive placers in this county in 1909, of which 6 were hydraulic, 3 drift, and 2 sluicing mines. Their combined output for the year was $10,986 in gold and $68 in silver, no single one being a large producer.

In Harney County there were 3 small placers which were productive, their combined yield being $815 in gold and $5 in silver. These mines are at Harney City and Burns.

JACKSON COUNTY.

In 1909 Jackson County produced 4,848.04 fine ounces in gold, valued at $100,218, and 1,938 ounces of silver, valued at $1,008, as well as 400 pounds of lead, valued at $17, a total of $101,243. This shows an increase in value for 1909 of $33,285 in gold and $290 in silver. No lead was produced in 1908, and only a small quantity in 1909. There were 18 producing mines in 1909, of which 5 were deep, 10 were hydraulic, 2 were dredges, and 1 was a sluicing placer. The deep mines produced $29,606 in gold, $526 in silver, and 400 pounds of lead, valued at $17, from 5,329 tons of ore. Included in these totals was $8,925 in gold and $75 in silver from 80 tons of concentrates. The tonnage in this county was increased 2,036 tons in 1909 over 1908. The most productive deep mine was that of the Opp Mining Company at Gold Hill. The other deep mines are at Applegate, Ashland, and Trail. The combined output of the placers in this county in 1909 was $70,612 in gold and $482 in silver, a total of $71,094.

The most productive mine in the county, of any kind, was that of the Champlin Dredging Company, at Gold Hill. The other dredge was operated by the White-Shebley Company, at Woodville. The placer operations were conducted at Applegate, Draper, Gold Hill, Rock Point, and Woodville. Three of the hydraulic mines produced over $6,000 each, the others being smaller operators.

JOSEPHINE COUNTY.

The total output of Josephine County in 1909 was valued at $180,402, as compared with $194,139 in 1908, a decrease of $13,737. Of the total production in 1909, the gold was 7,207.73 fine ounces, valued at $148,927; the silver was 1,644 ounces, valued at $855; and the copper was 235,000 pounds, valued at $30,550. There were 39 mines reporting production in 1909, or 24 less than in 1908. Of these 10 were deep mines and 29 were placers. The latter comprised 25 hydraulic mines, 1 drift mine, and 3 sluicing mines. The total amount of ore treated in Josephine County in 1909 was 5,962 tons, yielding $42,364 in gold; 981 ounces of silver, valued at $510; and 235,000 pounds of copper, valued at $30,550. There were 4,272 tons of ore milled, yielding $27,099 in gold and $384 in silver. There were also 1690 tons of ore smelted, yielding $15,265 in gold, $126 in silver, and 235,000 pounds of copper, valued at $30,550. The placer gold product was 5,158.37 fine ounces valued at $106,633, and 663 ounces of silver valued at $345, a total of $106,978, or $11,552 less than in 1908. The increase in tonnage in 1909 over that of 1908 was 1,395 tons. Deep mines in Josephine County were worked at Galice, Grants Pass, Merlin, Irondale, Placer, and Wolf Creek. The most productive district was at Galice, where 3 deep mines made a combined yield valued at $25,740, the mine of the Gold Road Mining and Milling Company being the largest. The deep mines of the county yielded $42,874 in gold and silver in 1909, and the placers yielded $106,978, the placer output thus exceeding in value the deep-mine output of gold and silver by $64,104. There was only one productive copper mine in the county in 1909. Placer mines of different kinds were worked at Galice, Golden, Grants Pass, Holland, Kerby, Leland, Merlin, Murphy, Placer, Provolt, Waldo, Williams, and Wolf Creek. Virtually all the gold from placers was derived from hydraulic mines, their output being $105,793 out of a total placer gold yield of $106,633 in 1909. In the placer mining districts the mines around Galice made a combined yield of $18,157 in gold and $37 in silver. The largest producer at that place was the Old Channel Mining Company. In Wolf Creek district the yield was $2,259 in gold and silver. At Holland the placer yield was $645 in gold and silver from Sucker Creek district. At Merlin, in Pickett Creek and Silver Creek districts, the yield was $3,894 in gold and silver. At Waldo the yield was $27,411 in gold and $51 in silver. The principal mine there was the Logan, a hydraulic mine. The most productive of the placer districts of the county was Grave Creek, at Placer, where the Columbia Mines Company operated a large hydraulic mine. The placers at Williams made a production of only $539. At Grants Pass, in Winona district, the total placer yield was $11,235 in gold and $37 in silver from 2 hydraulic mines.

LANE COUNTY.

In Lane County there were but 3 productive mines in 1909, all deep mines, located at Blue River, Bohemia, and Cottage Grove. The total output of the county from 3,212 tons of ore, including 1,000 tons of old tailings, was 685.57 fine ounces of gold, valued at $14,172, and 1,335 ounces of silver, valued at $694, a total of $14,866. The most important producer in the county was the West Coast Mines Company, at Bohemia.

MALHEUR AND WHEELER COUNTIES.

Malheur County in 1909 produced 2,048.83 fine ounces of gold, valued at $42,353, and 1,540 ounces of silver, valued at $801, an increase in value of gold and silver output of $28,404. In 1908 there were 8 producing placers and no deep mines; in 1909 there were producing 5 deep mines and 3 hydraulic placers. The deep mines produced 3,954 tons of ore, valued at $39,243 in gold and $782 in silver. From 3,950 tons of milling ore were derived 123 tons of concentrates, valued at $6,194 in gold and $438 in silver. Four tons of ore were smelted, yielding $489 in gold and $75 in silver. The deep mines are in Mormon Basin district, at Malheur. The most productive deep mine was that of the Humboldt Gold Mines Company. The producing placers were also in the Mormon Basin district. They were all hydraulic properties, and their combined output was valued at $3,110 in gold and $19 in silver, a total of $3,129.

Wheeler County had also 3 productive placer mines in 1909, all hydraulic and all at Dayville, with a combined yield valued at $4,685 in gold and $26 in silver, a total of $4,711. The increase in output of the county in gold and silver in 1909 was $3,692.

SOUTH DAKOTA.

By Charles W. Henderson.

PRODUCTION.

The total value of the production of gold, silver, copper, and lead in South Dakota for the calendar year 1909, as reported by 31 producers, including 5 placers, amounted to $6,694,313. This was a decrease of $1,095,875, as compared with the output of 1908. The yield of gold, the principal metallic output, was 318,202.82 fine ounces, valued at $6,577,836, a decrease of 52,222.76 fine ounces, valued at $1,079,540. Silver decreased proportionately, the production of that metal being 194,273 fine ounces, as compared with 248,762 fine ounces in 1908, a decrease of 54,489 fine ounces. The lead production in 1909 was 1,512 pounds, as against 23,046 pounds in 1908. For the first time in the history of the Black Hills an appreciable quantity of copper was produced in 1909. The ore treated during the year contained 118,385 pounds of copper.

There were 26 deep mines in 1909, as compared with 19 in 1908, and 5 placer properties were worked during the year, as compared with 8 in 1908. The production from placers was only 57.03 fine ounces of gold as compared with an output of 480.95 fine ounces of gold in 1908.

The total ore mined and treated in 1909 was 1,704,141 short tons, with an average value in gold of $3.859, as compared with 1,929,549 short tons, averaging $3.963 in 1908.

Mine production of gold, silver, and associated metals in South Dakota in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) and decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold............fine ounces..	370,425.58	$7,657,376	318,202.82	$6,577,836	−52,222.76	−$1,079.540
Silver..................do....	248,762	131,844	194,273	101,022	− 54,489	− 30,822
Copper..............pounds..			118,385	15,390	+ 118,385	+ 15,390
Lead...................do....	23,046	968	1,512	65	− 21,534	− 903
Total..................		7,790,188		6,694,313		− 1,095,875

The shut down of the Homestake mines and mills (which produce over 75 per cent of the State output every year) on November 23, 1909, curtailed operations on the part of the other mills in Lawrence County and resulted in a decrease of over $1,000,000 in the value of the yield of South Dakota for that year. Had the Homestake Company continued operations throughout the year, the production of gold would have been very close to the record output of the year 1908. As it was, the gold output was about the average for the last decade, as is shown in the following table:

Production of gold in South Dakota for the years 1900 to 1909, inclusive.[a]

Year.	Gold.	
	Quantity.	Value.
	Fine ounces.	
1900..........	298,841.41	$6,177,600
1901..........	313,445.82	6,479,500
1902..........	336,951.23	6,965,400
1903..........	330,243.00	6,826,700
1904..........	356,232.40	7,363,977
1905..........	338,116.70	6,989,492
1906..........	330,956.06	6,841,469
1907..........	200,184.80	4,138,189
1908..........	370,425.58	7,657,376
1909..........	318,202.82	6,577,836
Total 1900-1909..........		66,017,539
Yearly average..........		6,601,754

[a] Figures from Mineral Resources of the United States.

The closing of the Homestake mines and mills was caused by the demand of the Western Federation of Miners that all eligible men join the union at once and the company's decision on November 17, 1909, to employ none but nonunion men. Understanding that a strike was imminent, the company stopped all operations on November 23. Men were brought to Lead from mining districts in other States, and in January, 1910, the Homestake and 12 other companies declared for nonunion labor conditions and the establishment of the card system. The Homestake employees opposed to the policy of the union formed the Homestake Loyal Legion, unaffiliated with any union, and the company started part of its plant during January using nonunion men. Other companies resumed operations during the spring months.

During these labor agitations the Homestake Company continued work on its electric-power plant on Spearfish Creek. The chief problem of this work is in constructing a series of 8 tunnels through the mountains which will have an aggregate length of 5 miles.

All the mills in the Maitland, Whitewood, and Portland districts, except the Golden Reward mill at Terry, were idle during part of the year or ran below full capacity. The Mogul, Golden Reward, and Lundberg, Dorr & Wilson mills all grind their ore with Chile mills and are using the Moore process for treating the slimes, whereas several years ago stamping and decantation were in general use.

Custer County made about the same yield as in the year 1908. The Saginaw Gold Mining Company was the only deep mine operator in this county and there were no producing placer mines.

Pennington County's output for 1909 showed a material increase. The Continental Copper Mining and Smelter Company, at Hill City, ran its smelter for a period of sixty-six days.

Placer mining in Lawrence and Pennington counties showed a decrease.

Source of gold and silver production in South Dakota in 1909.

Source.	Number of mines.	Tonnage.	Gold.		Silver.		Total value.
			Quantity.	Value.	Quantity.	Value.	
Deep mines:		*Short tons.*	*Fine ounces.*		*Fine ounces.*		
Siliceous ore	26	1,702,266	318,102.49	$6,575,762	191,251	$99,450	$6,675,212
Copper ore		1,875	43.30	895	3,009	1,565	2,460
		1,704,141	318,145.79	6,576,657	194,260	101,015	6,677,672
Placer mines	5	....	57.03	1,179	13	7	1,186
Total	31	1,704,141	318,202.82	6,577,836	194,273	101,022	6,678,858

CUSTER COUNTY.

One operating company produced in 1909 bullion equal in value to that produced in 1908. The value for the county can not be given without disclosing individual production, and Custer County is again tabulated with Pennington County.

The Saginaw Gold Mining and Milling Company, of Custer, ran its newly constructed mill for a short time. This plant, built in 1908, consists of a stamp (copper) plate-amalgamation mill, with concentration tables, and a 50-ton cyanide and slime plant. The 80-ton Chilean mill completed by the Ideal Mining Company, of Custer, in 1909, was not operated until 1910. On the property of the Ruberta Mining Company a 25-ton amalgamation and cyanide plant was built. Only development work was done on the Ruberta mine. Neither the Granite Reef nor the Empire-Baker properties were operated in 1909.

LAWRENCE COUNTY.

Mine production of gold, silver, copper, and lead in Lawrence County, S. Dak., in 1908 and 1909.

Year.	Gold.		Silver.		Copper.		Lead.		Total.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
	Fine ounces.		*Fine ounces.*		*Pounds.*		*Pounds.*		
1908	370,094.05	$7,650,523	248,686	$131,804	....	....	23,046	$968	$7,783,295
1909	317,418.75	6,561,628	191,044	99,343	3,977	$517	1,512	65	6,661,553
Increase (+) or decrease (−)	−52,675.30	−1,088,895	−57,642	−32,461	+3,977	+517	−21,534	−903	−1,121,742

The chief producing mines of South Dakota are in Lawrence County. Of the $6,577,836 in gold produced, this county is credited with $6,561,628.

There were 1,699,260 short tons of siliceous ore treated from 16 deep mines in 1909, with an average value per ton in gold of $3.86 and in silver of $0.06, as compared with 13 operating properties in 1908, with an output of 1,927,808 short tons and an average value per ton of $3.96 in gold and $0.07 in silver. In 1909 there were treated 1,691,135 tons in the mills of the county, which yielded to the amalgamating plates and cyanide treatment $6,421,199 in gold and 180,421 fine ounces of silver, a total valuation of $6,515,018, at an average value per ton in gold and silver of $3.85. To smelters outside the State were sent 8,125 tons, valued in gold and silver at $145,361, at an average of $17.89 per ton.

There was a considerable decrease in placer output, only 1 placer property reporting operations during the year as compared with 4 operators in 1908.

The Homestake Company operated steadily until November 23, when both mines and mills were closed to avoid a strike. The Mogul, Golden Reward, Portland, Imperial, and Wasp companies did not work the full year. Most of them were seriously hampered by the June flood; the Wasp Company closed down several times to make repairs. The Minnesota Mines Company also made a reduced yield. The Lundberg Dorr & Wilson mill, a 100-ton cyanide plant with a 6-foot Chilian mill, at Terry, treated custom ore from the Portland Company and also handled its own product from the Buxton and Bonanza properties. The North Homestake mill was operated for a short time. The Reliance Mining Company, near Stewart, did not operate at full capacity. There were no new developments in the siliceous ore mines of the Maitland, Portland, and Whitewood districts. The Homestake continued throughout the year construction work on its electric-power plant, which is expected to be completed and in operation before the end of the year 1910 and will add from 3,000 to 4,000 horsepower to the present electric power in use.

In the Galena, or Bear Butte, district the Gilt Edge-Maid Gold Mining Company, at Turner, working a very large body of low-grade ore in porphyry, ran its mill a short time during the year. The Branch Mint Operating Company, which worked the 120-stamp mill on the Branch Mint property, treated some dump ore during the first half of the year. The Golden Crest Mining Company, also mining in porphyry near the Gilt Edge-Maid, completed its 200-ton mill, the process of which is to crush with stamps, regrind with tube mill, and treat the whole product by the Moore process. The shaft was enlarged and deepened.

PENNINGTON COUNTY.

The deep mines of Pennington County made a notable increase in output in 1909. Gold from placers was a little under the output of 1908.

At Hill City, the Gold Medal Mining Company worked its 5-stamp mill for four months on ore from the Gold Medal and Golden Summit mines. The Continental Copper Mining and Smelting Company, at Hill City, operated, during a period of 66 days, its 185-ton smelter on ores from its own mine, the Dakota-Calumet. At the close of the year the workings on the property consisted of a 780-foot shaft and an adit 1,170 feet long.

In the Hornblende district, near Rochford, operations were confined to the North Star Company and the Stanby Mining Company. The workings on the Stanby mine now are a 400-foot shaft and a 3,500-foot adit.

At Keystone a small yield of gold and silver was taken from the Columbia, the Krupp, and the Keystone Holy-Terror mines. The Columbia is opened by a 350-foot adit. The development work on the Krupp mine consists of a 500-foot adit. On the Lisbon property 350 feet of development drifts were run in 1909 and ore was placed on the dumps.

At Oreville, the Forest City Mining Company operated its 10-stamp plate-amalgamation mill on ore from the Clara Belle mine.

A little placer gold was washed out by the Pittsburg-Rockerville Mining Company from its Placerville Bars mine, at Rapid City. The McCurdy placer at Pactola was worked by drifting and sluicing. An increased output was made from the Rockerville Gulch placer, in the Tepee district, near Rockerville.

TEXAS.

By Charles W. Henderson.

PRODUCTION.

The following table shows the production of gold, silver, copper, lead, and zinc in Texas in 1908 and 1909:

Production of gold, silver, copper, lead, and zinc in Texas in 1908 and 1909.

Year.	Gold.		Silver.		Copper.		Lead.		Zinc.		Total value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
	Fine ounces.		*Fine ounces.*		*Pounds.*		*Pounds.*		*Pounds.*		
1908	....	....	444,336	$235,498	28,364	$3,744	65,833	$2,765	35,957	$1,690	$243,697
1909	15.19	$314	374,444	194,711	3,862	502	91,140	3,919	....	....	199,446
Increase (+) or decrease (−)	+15.19	+314	−69,892	−40,787	−24,502	−3,242	+25,307	+1,154	−35,957	−1,690	−44,251

The total value of the production of gold, silver, copper, lead, and zinc in the State of Texas in the calendar year 1909, as compared with that of 1908, shows a decrease of $44,251. Silver constituted over 95 per cent of the value, the production being 374,444 fine ounces, valued at $194,711, in 1909. The output of copper, the chief metal of El Paso County, was 24,502 pounds less than in 1908. The lead production from El Paso and Presidio counties, and chiefly from the latter, was 91,140 pounds, valued at $3,919, an increase of 25,307 pounds in quantity and of $1,154 in value. There was no zinc produced in the State in 1909, as compared with a yield of 35,957 pounds, valued at $1,690, in 1908.

Of the 6 mines which made an output in 1909, there were 2 in Sierra Blanca district, El Paso County, 3 in the Shafter district, and 1 prospect in Abilene, Taylor County.

The total tonnage milled or shipped was 21,762 short tons, of which 10 tons was copper ore, 44 tons was lead ore, and the remainder was siliceous ore. Only a nominal percentage of the total tonnage was smelted, nearly all of the ore being milled. All the silver, except 496 ounces from lead ores and 38 from copper ores, came from dry ores.

The average recovered value per ton in silver from dry ores (including tailings) was $8.96. The average assay of ore shipped to the smelter was 0.193 ounce gold and 32.86 ounces silver per ton. The copper ore shipped assayed 18 per cent in copper and the lead ore averaged about 38 per cent in lead and about 11.3 ounces in silver per ton.

EL PASO COUNTY.

The Sierra Blanca (or Lasca) district was the scene of several small mining operations in 1909. Ore was shipped from the Little Lightning mine and the McKinney mine.

In the Allamoore district, at the southern foot of the Sierra Diablo range, is the Hazel mine, in pre-Cambrian sandstone.[a] This was formerly an important silver-copper producer, and it was reported in 1909 that it would be reopened early in 1910.

Farther to the east, in the Plateau district, considerable activity during the year was reported, with the possibility that zinc ore would be shipped during 1910.

PRESIDIO COUNTY.

At Shafter, Presidio County, is located the Presidio Mining Company's mines, from which the greater part of the silver and lead output of the State has come since 1884. At the close of the year, the workings on the property consisted of two vertical shafts, 400 and 700 feet deep. There were driven 2,423 feet of drifts, crosscuts, and other development work in 1909. The milling plant is a 15-stamp mill in which the pan-amalgamation process is used. Some output was made in 1909 in working over the old tailings at the mine. Shipments of lead ore were made from the Young mine in this district.

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[a] Richardson, G. B. Reconnaissance of trans-Pecos, Texas: Bull. Univ. Texas Mineral Survey No. 9, 1904, pp. 24–25.

UTAH.

By V. C. Heikes.

PRODUCTION.

There were 179 producing mining properties in Utah in 1909 against 182 in 1908. The number of reports received in 1909 included those for 5 placers, of which there were 6 in 1908. These mining operations carried on in 39 districts, distributed in 16 counties out of 27 in the State, aggregated a production of gold, silver, copper, lead, and zinc valued at $31,380,092. Copper production again showed a large increase, from 86,843,812 pounds in 1908 to 108,947,811 pounds in 1909, valued in 1909, at its average commercial value, at $14,163,215, which was 45 per cent of the total value of the metals. Lead was second in value, amounting to 148,486,463 pounds, valued at $6,384,918; silver was third, aggregating 11,717,172 ounces, valued at $6,092,929; and gold was fourth, valued at $4,206,548. The greatest quantity of gold was produced from deep mines in Juab, Salt Lake, and Tooele counties. Juab and Summit County deep mines were first in yield of lead and silver; and Salt Lake County made the chief production in copper. Wasatch County, or that part of it embraced by the Park City region, was credited with the largest part of the zinc yield; Tooele County was next in importance.

The total production of crude ore aggregated 5,122,589 tons, of which 287,659 tons were treated in milling plants using principally the cyanide process; 3,771,960 tons were treated at concentration mills, producing 262,401 tons of concentrates; and the remainder, 1,003,575 tons, was shipped directly to smelting establishments. Tooele County continued to be the greatest field in the State for the treatment of the low-grade siliceous gold ores by the cyanide process. Salt Lake County has become famous for its great concentration mills, which treated three-fourths of the total ore mined in the State. Its mines also yield the largest quantity of ore of shipping grade, which goes directly from the mines to the smelters. Juab County mines hold second place in this respect.

Placer mining along Colorado and Green rivers attracted some attention during 1909, but the production of gold from this source was of little importance.

The variation in the metallic production of Utah during 1908 and 1909 is shown in the table which follows:

Mine production of gold, silver, and associated metals in Utah in 1908 and 1909.

Metal.	1908.		1909.		Increase.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold............fine ounces..	179,054.60	3,701,387	203,491.76	4,206,548	24,437.16	505,161
Silver....................do....	8,451,338	4,479,209	11,717,172	6,092,929	3,265,834	1,613,720
Copper..............pounds..	86,843,812	11,463,383	108,947,811	14,163,215	22,103,999	2,699,832
Lead.....................do....	88,777,498	3,728,655	148,486,463	6,384,918	59,708,965	2,656,263
Zinc.....................do....	1,460,554	68,646	9,860,778	532,482	8,400,224	463,836
Total..............	....	23,441,280	....	31,380,092	....	7,938,812

Total tons of ore sold or treated in Utah in 1904–1909, and total content of gold, silver, and associated metals.

Year.	Tonnage.	Gold.[a]	Silver.[a]	Copper.	Lead.	Zinc.	Total value.
	Short tons.	*Fine ounces.*	*Fine ounces.*	*Pounds.*	*Pounds.*	*Pounds.*	
1904	1,716,947	202,675.00	12,049,446	46,417,234	116,479,764	73,439	$21,989,415
1905	2,181,061	248,692.00	11,036,471	57,298,054	103,882,009	3,330,327	25,824,387
1906	2,348,819	252,439.43	11,550,634	56,593,576	125,342,836	6,474,615	31,419,365
1907	2,669,696	247,759.63	10,990,076	64,256,884	115,938,037	5,452,916	31,692,911
1908	3,658,957	179,054.60	8,451,338	86,843,812	88,777,498	1,460,554	23,441,280
1909	5,122,589	203,491.76	11,717,172	108,947,811	148,486,463	9,860,778	31,380,092

[a] Includes a very small placer production.

Of the nine smelting plants in Utah five were in operation in 1909. Four of them operated during the entire year—the Garfield and Yampa copper plants and the Murray and Midvale lead plants. The Tintic lead plant operated during a part of 1909. All the plants carried on a custom business, except the Yampa, which bought custom ores only for fluxing. Nearly all the ores produced in 1909 were smelted by the Utah smelters; a small percentage of lead ore and zinc ore and concentrate went to Colorado smelters, a car of rich siliceous gold ore to an eastern smelting establishment, and the zinc ores and concentrates to Oklahoma, Kansas, and Ohio. Lessees sorted a shipping product aggregating 1,692 tons from the old slag dumps at Frisco, in Beaver County, and from around the old smelter sites and dumps near Murray. The metallic content of the relatively small amount of slag produced and old tailings treated in various mining camps is included in the total figures.

ORE PRODUCTION IN 1909.

The production of ore in Utah in 1909 was 5,122,589 short tons, including 1,692 tons of old slag sortings and the re-treatment of 57,703 tons of old tailings, one-fifth of them producing concentrate, the remainder gold bullion from treatment by the cyanide process. Compared with the production of 1908, the total production of ore mined and treated increased 1,463,632 short tons in quantity, but in value per ton decreased from $6.40 in 1908 to $6.12 in 1909, mainly due to the largely increased production of low-grade copper porphyries. Production of siliceous ores increased from 352,274 tons in 1908 to 358,116 tons in 1909. The greatest quantity of this kind of ore was produced in Tooele County. Copper ore increased from 2,976,433 tons in 1908 to 4,216,226 tons in 1909. Salt Lake County had the greatest output of copper ore, Juab County following. The production of lead ore increased from 321,417 tons in 1908 to 480,248 tons in 1909, Salt Lake County leading in production, with Summit County following. Zinc ore increased from 99 tons in 1908 to 3,264 tons in 1909. The ore is a zinc silicate and is mined principally in Tooele County, though some has been produced from mines in Beaver County. Copper-lead ore decreased from 6,734 tons in 1908 to 4,460 tons in 1909, the decrease being largely due to reduced shipments of this class of ore from Bingham. Lead-zinc ore increased from 2,000 tons in 1908 to 60,275 tons in 1909. In this classification are included old tailings of the Park City region, from which a lead-zinc concentrate was produced. The average value per ton of gold and silver in siliceous ore in 1909 was \$3.41 as against \$3.03 in 1908; in copper ore, 88 cents as against \$1.24 in 1908; in lead ore, \$10.55 in 1909 as against \$10.47 in 1908. The gold and silver content of zinc ore averaged \$5.86 in 1908 and was contained in a small output from a Beaver County mine; there was no zinc ore shipped from Beaver County in 1909, and the zinc ore of Tooele County contains no values in gold or silver. Copper-lead ore averaged \$12.13 per ton in 1909 against \$7.05 in 1908, and lead-zinc ore \$3.86 in 1909 against \$2.65 in 1908.

Subdivision of tonnage, by kinds, of ore sold or treated from Utah in 1909, by counties, in short tons.

County.	Silver ore.	Copper ore.	Lead ore.	Zinc ore.	Copper-lead ore.	Lead-zinc ore.	Total.
Beaver	17	41,552	12,808	....	2,593	897	57,867
Boxelder, Millard,[a] Morgan, and Washington	1,166	30,055	52	....	....	....	31,273
Grand, San Juan, and Uinta	30	16	....	....	....	....	46
Iron and Piute	641	35	....	....	....	....	676
Juab	11,296	119,661	52,376	....	46	....	183,379
Salt Lake	8,112	4,024,849	146,769	....	899	....	4,180,629
Summit and Wasatch	1,132	57	135,605	....	....	59,378	196,172
Tooele	335,698	1	53,840	3,264	922	....	393,725
Utah	24	....	78,798	....	....	....	78,822
Total	358,116	4,216,226	480,248	3,264	4,460	60,275	5,122,589
Value per ton in gold and silver	\$3.41	\$0.88	\$10.55	....	\$12.13	\$3.86	\$2.01

[a] No production in 1908.

Relative production in Utah in 1908 and 1909, by classes of ore deposits.

	Percentage of ore mined and average recovery.											
	Disseminated deposits.				Replacement deposits in limestone.				Fissure veins.			
	Percentage of total.		Yield per ton.		Percentage of total.		Yield per ton.		Percentage of total.		Yield per ton.	
	1908.	1909.	1908.	1909.	1908.	1909.	1908.	1909.	1908.	1909.	1908.	1909.
Tonnage and total value	64	67	\$3.22	\$2.74	35	31	\$8.45	\$12.97	1	1	\$18.43	\$16.77
			Oz.	*Oz.*			*Oz.*	*Oz.*			*Oz.*	*Oz.*
Gold	10	12	0.007	0.007	86	87	0.078	0.111	4	1	0.071	0.029
Silver	2	2	.069	.066	95	95	1.46	6.96	3	3	7.40	5.56
			Per cent.	*Per cent.*			*Per cent.*	*Per cent.*			*Per cent.*	*Per cent.*
Copper	63	63	1.15	0.985	36	36	2.00	1.22	1	1	0.94	0.64
Lead	......	......	......	......	91	89	.78	4.13	9	11	12.57	13.51
Zinc	......	......	......	......	100	100	.134	.305	......	......	......	......

GOLD.

The gold output of Utah for 1909, as reported by the producers, aggregated 203,491.76 fine ounces, valued at \$4,206,548, an increase of \$505,161. The gold was principally produced from deep mines located in the Tintic district of Juab and Utah counties, West Mountain or Bingham district of Salt Lake County, and Camp Floyd district of Tooele County. Increases are to be noted in all the districts, except Camp Floyd, where the gold output has been on the decline for the last six years. The placer production is very small, but developments on Green River give promise of increasing the yield of gold from this source during the next year. Over half of the gold produced in Utah was from copper ores, about a fourth was credited to siliceous ores, and a fifth to lead ores. Milling plants, using principally the cyanide process, treated 287,659 tons of ore, which yielded $824,009, or 19.5 per cent of the total value of the gold produced in Utah, an average of $2.86 per ton. Tooele County is credited with the greatest yield from gold ores. From 3,771,960 tons of ore treated at concentration mills in 9 mining districts 262,401 tons of concentrates were saved, containing $630,619, or about 15 per cent of the total gold production, and an average value per ton of $2.36. In 1908 there were 2,522,734 tons treated, which yielded 184,052 tons of concentrate, containing $437,851 in gold, an average of $2.38 per ton. There were shipped to smelters in 1909, 1,003,575 tons of crude ore, containing $2,747,898 in gold, an average value per ton of $2.74, as against 786,038 tons of crude ore shipped, containing $2,300,674 in gold, averaging $2.93 per ton in 1908. The gold yield from placer mining in 1909 amounted to $2,525, a decrease of $6,585 from that reported in 1908. Most of the placer gold came from San Juan County and surface placers in Grand County.

Source of gold production of Utah, by kinds of ore, in 1909, by counties, in fine ounces.

County.	Placers.	Silver ore.	Copper ore.	Lead ore.	Zinc ore.	Copper-lead ore.	Lead-zinc ore.	Total.
Beaver	....	44.30	250.42	413.87	....	46.33	8.00	762.92
Boxelder, Millard, Morgan, and Washington [a]	....	337.58	.08	.44	....	....	....	338.10
Grand, San Juan, and Uinta	122.15	10.00	2.29	....	....	....	....	134.44
Iron and Piute	....	316.86	8.80	....	....	....	....	325.66
Juab	....	7,037.29	50,383.68	12,629.40	....	1.27	....	70,051.64
Salt Lake	....	1,350.16	66,618.83	5,991.19	....	46.94	....	74,007.12
Summit and Wasatch	....	435.77	1.75	3,173.48	....	....	1,203.18	4,814.18
Tooele	....	39,399.37	....	283.29	....	8.35	....	39,691.01
Utah	....	....	....	13,366.69	....	....	....	13,366.69
Total	122.15	48,931.33	117,265.85	35,858.36	....	102.89	1,211.18	203,491.76

[a] No production in 1908.

SILVER.

Utah ranked second to Montana as a silver producer in 1909, the output aggregating 11,717,172 fine ounces, valued at $6,092,929, at the average value of silver of 52 cents per fine ounce in 1909. This indicated an increase in output of 3,265,834 ounces in quantity and $1,613,720 in value. The output of silver comes mainly from the lead ores, from which source were derived 8,314,766 ounces. Tintic district in Juab and Utah counties produced 6,404,857 ounces, the Park City region in Summit and Wasatch counties, 2,825,385 ounces, and the Bingham or West Mountain district, 1,615,394 ounces. The quantity of crude ore shipped to smelters increased from 786,038 tons in 1908 to 1,003,575 tons in 1909. The silver from this ore increased from 7,148,583 ounces, averaging 9.09 ounces per ton in 1908 to 9,956,271 ounces, averaging 9.92 ounces per ton in 1909. At concentration mills 262,401 tons of concentrates were made in 1909, yielding 1,748,861 ounces of silver, an average of 6.66 ounces per ton, as against 184,052 tons of concentrate containing 1,273,583 ounces of silver, an average of 6.92 ounces per ton, in 1908. The silver extracted from ore at cyanide and amalgamation mills, at which 287,659 tons were treated, yielded 5,153 ounces, averaging 0.018 of an ounce per ton in 1909. This decided decrease in silver from this source was caused by the closing of the mills in the Gold Mountain district in Piute County. In 1908 there were 313,845 tons of ore treated by cyanidation and amalgamation, yielding 18,662 ounces of silver, averaging 0.059 ounce per ton.

Source of silver production of Utah, by kinds of ore, in 1909, by counties, in fine ounces.

County.	Placers.	Silver ore.	Copper ore.	Lead ore.	Copper-lead ore.	Lead-zinc ore.	Total.
Beaver		83	5,361	209,520	50,891	8,122	273,977
Boxelder, Millard,[a] Morgan, and Washington		3,678	6,913	219			10,810
Grand, San Juan, and Uinta	22	8	1,418				1,448
Iron and Piute		1,781	909				2,690
Juab		262,849	1,448,666	1,832,149	1,254		3,544,918
Salt Lake		94,769	1,037,380	624,526	23,898		1,780,573
Summit and Wasatch		24,270	70	2,409,771		391,274	2,825,385
Tooele		14,560		243,238	23,915		281,713
Utah		315		2,995,343			2,995,658
Total	22	402,313	2,500,717	8,314,766	99,958	399,396	11,717,172

[a] No production in 1908.

COPPER.

In 1909 the output of copper amounted to 108,947,811 pounds, valued at $14,163,215 at the average price for the year of 13 cents per pound, an increase of 22,103,999 pounds, which was credited almost entirely to West Mountain or Bingham district in Salt Lake County. Tintic district in Juab County, and Lucin district in Boxelder County supplied the next largest quantities. Seven counties showed decrease in copper output, the largest being that of Beaver. Nearly all the copper was produced at the Garfield smelter and the Yampa plant near Bingham. About two-thirds of the copper produced in 1909 was from the low-grade porphyry ores at Bingham in Salt Lake County and Newhouse in Beaver County. The quantity of porphyry ore mined in those districts aggregated 3,420,288 tons, and yielded concentrates consisting principally of chalcocite, chalcopyrite, and some bornite. The average recovery per ton from these concentrates was 0.16 ounce of gold, 1.54 ounces of silver, and 23.27 per cent of copper. The ores classed as copper ore yielded 95.4 per cent of the total copper; lead ore was credited with 3.67 per cent of the total copper, and copper-lead ore with 0.5 per cent. Siliceous and lead-zinc ores produced minor amounts of copper. Copper ores aggregating 4,216,226 tons yielded an average per ton of 24.65 pounds of copper; lead ores, 480,248 tons in quantity, yielded 8.34 pounds of copper per ton; lead-zinc ores and tailings yielded from 60,275 tons 2.88 pounds of copper per ton; siliceous ores, aggregating 358,116 tons, carried 0.83 pound of copper per ton. A large part of the tonnage of the siliceous ores contained no copper. Crude ores shipped directly to the smelters in 1909 were mainly sulphide, and yielded from 1,003,575 tons, 38,498,880 pounds of copper, an average of 1.92 per cent. In 1908 the corresponding figures showed 786,038 tons of crude ore treated, yielding 31,948,303 pounds of copper, an average of 2.03 per cent.

LEAD.

Lead increased in output from 88,777,498 pounds in 1908 to 148,486,463 pounds in 1909. At its average price of 4.3 cents per pound, the total output in 1909 was valued at $6,384,918. The greatest yield was made in the Tintic district, which was responsible for over half of the increase, and in Park City, Bingham, and mines in Beaver County. Tintic district in 1909 yielded from its ores 56,502,209 pounds of lead; the Park City region, 46,350,390 pounds; Bingham district, 30,365,819 pounds; Ophir district in Tooele County, 5,941,455 pounds; and Beaver County mines, 5,766,356 pounds. Crude ores to smelters contained 105,527,425 pounds of lead from 400,174 tons of ore, which averaged 13.18 per cent of lead. Some lead contained in copper ore, shipped to copper smelters, was eliminated from tabulation. Concentrates containing lead and a small quantity of copper, produced at concentration mills, aggregated 110,112 tons and contained 42,959,038 pounds of lead, averaging 19.5 per cent of lead. Ores classed as lead ores aggregated 480,248 tons, which produced 91.2 per cent of the total output of lead, and averaged 282.17 pounds of lead per ton. Copper-lead ore contained less than 1 per cent of the total lead, but yielded 322.96 pounds of lead per ton. Siliceous ores contained an unimportant amount of lead.

ZINC.

The total recoverable zinc, after concentrating and smelting losses are accounted for, from ore and concentrates produced in Utah in 1909, and calculated as spelter, was 9,860,778 pounds, which, at its average price for the year of 5.4 cents per pound, was valued at $532,482. In 1908 the output of spelter was 1,460,554 pounds, valued at $68,646. The Park City region in 1909 was credited with the largest quantity, or 6,737,237 pounds of spelter, produced from concentrate, which was largely the yield of a dump of middling accumulated during several years' operation of the Daly Judge mill. The middling was re-treated in a dry concentration mill at Park City, the property of the Grasselli Chemical Company, of Cleveland, Ohio, and the zinc concentrate was shipped to its eastern refineries. The lead and iron concentrate separated in treatment of the middling was sold to the Salt Lake smelters. The Daly West mill was equipped for saving zinc concentrate during 1909, and a few shipments were made to Colorado before the end of the year. An important tonnage of zinc silicate ore from the Scranton mine in Tooele County was produced and shipped. The United States Smelting and Refining Company has lately introduced at its Midvale concentration plant the Huff electrostatic method of separation, and is producing a zinc concentrate which is shipped to Kansas. At the present time only the ores of its Bingham mines are treated and the zinc separated. Later it is expected to seek custom ores containing zinc.

MINING INDUSTRY OF UTAH IN 1909.

Most of the mining districts of Utah made strides toward a record production of ore, which marks the year 1909 as one of the greatest in its history. None of the various mining camps declined, but several have not quite recovered from the panic of 1907. Great undertakings were brought to higher planes of efficiency and production costs were lowered. There has been a tendency toward mine consolidations and the securing of control of valuable properties by large investment interests. The Utah Copper Company at the close of the year arranged for taking control of the Boston Consolidated mines and its concentration mill. The Ajax mine was absorbed by the Golden Chain Company; the United States Mining Company was in control of the Bullion-Beck and Champion mines in the Tintic district; and the Red Wing-Butler Liberal mines at Bingham went to the control of the North-Utah Mining Company. At Stockton the Honerine mines and three other groups were consolidated as the Bullion Coalition mines.

The properties of the Bingham Mines Company, after being idle for some time, resumed operations, and its Mascotte drainage tunnel, which was driven west toward Bingham, was completed—a distance of approximately 3 miles from its portal at Lark. Another company is driving eastward toward Bingham from the Tooele County side and has about half completed its drainage and transportation adit, which is to be 12,000 feet long. Park City is to have another drainage outlet—the Snake Creek adit—besides the Ontario bore. The new adit is to be used principally in draining the Daly Judge mine, and, as it will gain greater depth than others driven for drainage purposes, it is expected the Snake Creek adit will be extended to other properties. In the Tintic district a long tunnel is being driven to connect with the Centennial-Eureka mine shaft, to be used for drainage and transportation.

During 1909 the smelter situation improved, especially with reference to the injunctions against the United States Smelting and Refining Company. This company treated at its Midvale smelter 373,090 tons of charge during 1909. (Midvale is the new name adopted by the town formerly known as West Jordan.) The lead smelter operated practically to its full capacity most of the time, a remarkable record in view of the small tonnage of ore offered for sale, on account of the low price of metals. The system of chemical treatment of the smelter gases and subsequent filtering in a bag house was in operation throughout 1909, and it accomplished all that was expected of it. Not only have all damaging effects of gases been eliminated and the demands of the farming community been satisfied, but the products recovered have gone a long way toward defraying the cost of operating the bag house. As a result of the success in the lead smelter, application was made to the United States district court for permission to operate the copper smelter with the same device, and this permission was granted. At the concentrator 8 tables, 3 slimers, and a regrinding plant were added and the zinc plant was completed. The latter contains 15 Huff electrostatic machines.

The American Smelting and Refining Company, with its Garfield copper plant and Murray lead smelter, took all the ores it could secure. These plants were operated at full capacity nearly the entire year, except during a short interval at the Murray lead plant as a result of a strike of the foreign workmen employed there. The Garfield smelter equipment was improved by the addition of a new basic-lined copper converter of the horizontal cylindrical type, 22 feet long and 10 feet in diameter, with a capacity of 40 to 50 tons of copper per day. Copper concentrates and flue dust are treated in a mud mixer with gypsum as a binder. In this form the concentrate is fed directly to the converter. At the new copper plant of the International Smelting Company, construction progressed without serious interruption in 1909. In the construction of the plant, a large part of the dismantled Highland Boy smelter, near Midvale, was used. The Yampa smelter, situated near Bingham, closed its converting department, and in December, 1909, commenced to supply matte under contract to the Garfield smelter. In October the mining operators in the Tintic district were disturbed by the closing of the Tintic smelter at Silver City. The smelting company was forced to suspend operations, because, it is said, of a lack of suitable smelting ores.

Mine production of gold, silver, copper, lead, and zinc in Utah in 1909, by counties.

County.	Ore sold or treated (short tons).	Gold.		Silver.	
		Quantity.	Value.	Quantity.	Value.
		Fine ounces.		*Fine ounces.*	
Beaver	57,867	762.92	$15,771	273,977	$142,468
Boxelder, Millard,[a] Morgan, and Washington	31,273	338.10	6,989	10,810	5,621
Grand, San Juan, and Uinta	46	134.44	2,779	1,448	753
Iron and Piute	676	325.66	6,732	2,690	1,398
Juab	183,379	70,051.64	1,448,096	3,544,918	1,843,357
Salt Lake	4,180,629	74,007.12	1,529,863	1,780,573	925,898
Summit and Wasatch	196,172	4,814.18	99,518	2,825,385	1,469,201
Tooele	393,725	39,691.01	820,486	281,713	146,491
Utah	78,822	13,366.69	276,314	2,995,658	1,557,742
Total	5,122,589	203,491.76	4,206,548	11,717,172	6,092,929

County.	Copper.		Lead.		Zinc.		Total value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
	Pounds.		*Pounds.*		*Pounds.*		
Beaver	1,247,235	$162,141	5,766,356	$247,953	656,457	$35,449	$603,782
Boxelder, Millard,[a] Morgan, and Washington	4,573,475	594,552	26,961	1,159			608,321
Grand, San Juan, and Uinta	2,047	266					3,798
Iron and Piute	3,632	472	881	38			8,640
Juab	5,899,016	766,872	21,532,691	925,906			4,984,231
Salt Lake	94,791,359	12,322,877	30,741,172	1,321,870	649,542	35,075	16,135,583
Summit and Wasatch	1,655,749	215,247	46,350,390	1,993,067	6,737,237	363,811	4,140,844
Tooele	747,341	97,154	7,623,664	327,818	1,817,542	98,147	1,490,096
Utah	27,957	3,634	36,444,348	1,567,107			3,404,797
Total	108,947,811	14,163,215	148,486,463	6,384,918	9,860,778	532,482	31,380,092

[a] No production in 1908.

Tons of ore sold or treated, number of deep mines producing, and value of ores in Utah in 1908 and 1909, by counties.

County.	Ore sold or treated (short tons).		Number of deep mines producing.		Average total value per ton.[a]		Average value per ton in gold and silver.[a]	
	1909.	Increase (+) or decrease (−).	1908.	1909.	1908.	1909.	1908.	1909.
Beaver	57,867	− 165,154	21	20	$4.54	$10.43	$0.57	$2.73
Boxelder, Millard,[b] Morgan, and Washington	31,273	+ 14,903	11	7	19.17	19.45	.47	.40
Grand, San Juan, and Uinta	46	+ 40	2	2	71.66	27.41	54.00	21.63
Iron and Piute	676	− 20,680	7	7	4.48	12.78	4.45	12.03
Juab	183,379	+ 40,794	37	35	26.57	27.18	18.72	17.95
Salt Lake	4,180,629	+1,482,692	47	44	4.43	3.86	.69	.59
Summit and Wasatch	196,172	+ 53,841	11	18	20.93	21.11	9.91	8.00
Tooele	393,725	+ 11,711	23	24	4.09	3.78	2.79	2.45
Utah	78,822	+ 45,485	11	17	51.75	43.20	28.12	23.27
Total	5,122,589	+1,463,632	170	174	6.40	6.12	2.23	2.01

[a] Value per ton, placer product excluded.

[b] No production 1908.

Tonnage of ore to gold and silver mills and concentrating mills, with gold and silver contained in bullion produced in Utah in 1909, by counties.

County.	Ore to gold and silver mills.			Ore to concentrating mills.
	Quantity.	Gold in bullion.	Silver in bullion.	
	Short tons.		*Fine ounces.*	*Short tons.*
Beaver	....	....	....	41,347
Boxelder, Millard,[a] Morgan, and Washington	1,118	$5,369	3,627	....
Grand, San Juan, and Uinta	30	207	8	....
Iron and Piute	550	4,536	1,332	....
Juab	....	....	....	....
Salt Lake	1	146	5	3,542,806
Summit and Wasatch	....	....	....	145,297
Tooele	285,960	813,751	181	38,984
Utah	....	....	....	3,526
	287,659	824,009	5,153	3,771,960

[a] No production in 1908.

Mine production of gold, silver, and associated metals from Utah concentrates in 1909, by counties.

County.	Quantity.	Gold.	Silver.	Copper.	Lead.	Zinc.	Total value.
	Short tons.	*Fine ounces.*	*Fine ounces.*	*Pounds.*	*Pounds.*	*Pounds.*	
Beaver	4,475	244.51	10,701	821,377	82,962	....	$120,965
Boxelder, Millard,[a] Morgan and Washington	....	....	....	....	....	....	....
Grand, San Juan, Uinta	....	....	....	....	....	....	....
Iron and Piute	....	....	....	....	....	....	....
Juab	....	....	....	....	....	....	....
Salt Lake	197,075	27,938.42	588,049	68,365,965	19,257,994	649,542	10,634,067
Summit and Wasatch	49,994	2,066.17	1,008,963	389,480	21,012,967	6,737,237	1,885,374
Tooele	9,976	117.26	121,858	483,743	2,068,512	....	217,623
Utah	881	139.85	19,290	....	536,603	....	35,996
	262,401	30,506.21	1,748,861	70,060,565	42,959,038	7,386,779	12,894,025

[a] No production in 1908.

Mine production of gold, silver, copper, lead, and zinc from Utah crude ore shipped to smelters in 1909, by counties.

County.	Crude ore.	Gold.	Silver.	Copper.	Lead.	Zinc.	Total value.
	Short tons.	*Fine ounces.*	*Fine ounces.*	*Pounds.*	*Pounds.*	*Pounds.*	
Beaver	15,617	517.94	262,723	425,800	5,673,296	656,457	$482,078
Boxelder, Millard,[a] Morgan, and Washington	30,155	78.35	7,183	4,573,475	26,961	....	601,065
Grand, San Juan, and Uinta	16	2.29	1,418	2,047	....	....	1,051
Iron and Piute	126	106.24	1,358	3,632	881	....	3,412
Juab	183,379	70,051.64	3,544,918	5,899,016	21,532,691	....	4,984,231
Salt Lake	637,033	45,989.71	1,186,207	26,037,086	11,440,300	....	5,444,273
Summit and Wasatch	42,710	2,748.01	1,816,422	1,266,269	25,337,423	....	2,255,471
Tooele	19,243	208.54	159,674	263,598	5,555,152	1,817,542	458,627
Utah	75,296	13,226.84	2,976,368	27,957	35,907,745	....	3,368,801
Total	1,003,575	132,929.56	9,956,271	38,498,880	105,474,449	2,473,999	17,599,009

[a] No production in 1908.

Number of mines classified by chief products in Utah, in 1909, by counties.

County.	Mines reporting product.	Gold placer mines.	Deep mines.							
			Silver.	Gold and silver.	Gold, silver, and copper.	Gold, silver, copper, and lead.	Gold, silver, copper, lead, and zinc.	Gold, silver, and lead.	Silver and lead.	Silver, lead, and zinc.
Beaver	20	......	......	......	1	10	1	6	2	......
Boxelder, Millard,[a] Morgan, and Washington	7	......	......	1	[b] 3	......	......	2	1	......
Grand, San Juan, and Uinta	7	[c] 5	......	1	1	......	......	......	......	......
Iron and Piute	7	......	......	3	3	......	......	1	......	......
Juab	35	......	......	2	[b] 7	16	......	5	5	......
Salt Lake	44	......	1	......	[b] 12	[d] 28	......	2	1	......
Summit and Wasatch	18	......	......	......	2	5	7	1	......	[e] 3
Tooele	24	......	......	5	[b] 10	[f] 8	......	......	......	1
Utah	17	......	1	......	......	10	......	5	1	......
Total	179	5	2	12	39	77	8	22	10	4

[a] No production in 1908.
[b] One silver and copper.
[c] One dredge.
[d] One silver, copper, lead.
[e] Gold in addition.
[f] Two silver, copper, lead.

PRODUCTION BY COUNTIES.

BEAVER COUNTY.

Mine production of gold, silver, and associated metals in Beaver County, Utah, in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold............fine ounces..	2,280.75	$47,147	762.92	$15,771	− 1,517.83	− 31,376
Silver....................do....	150,193	79,602	273,977	142,468	+ 123,784	+ 62,866
Copper...............pounds..	5,706,406	753,246	1,247,235	162,141	−4,459,171	−591,105
Lead......................do....	3,089,141	129,744	5,766,356	247,953	+2,677,215	+118,209
Zinc......................do....	54,902	2,580	656,457	35,449	+ 601,555	+ 32,869
Total	....	1,012,319	....	603,782	....	−408,537

Bradshaw district.—Four mine operators in this district reported in 1909 a yield aggregating $1,575 in gold, 769 ounces of silver, 3,357 pounds of copper, and 37,969 pounds of lead. All of the ore containing these metals was shipped to smelters and aggregated 124 tons, valued at $4,044, an average value of $32.61 per ton. In addition, about 900 tons of oxidized iron fluxing ore, containing 47 to 51 per cent iron and small gold values, were shipped from this district in 1909, principally from the Cave mine. Four miles north of the Cave mine the Nip and Tuck group of 8 claims became producers of ore which assayed $72.80 in gold, 3.3 ounces of silver, 1.3 per cent lead, and an excess in iron.

Lincoln district.—No shipments of ore were reported. Considerable zinc sulphide and carbonate ore from the Lincoln mine, which produced lead ore in 1908, remained on the dumps and may prove profitable when transportation facilities are improved.

Newton district.—Development of the Rob Roy and adjoining claims exposed free milling gold quartz during 1909, but no shipments were made.

Preuss district.—Development was continued in this district, but no shipments of ore were made.

San Francisco district.—Six producers of ore reported in 1909. The principal mines operated were the Horn Silver, Cactus, and Beaver Carbonate. The ore mined aggregated 53,385 tons, one-fourth of which was shipped direct to smelters, the remainder being treated at 2 concentration mills. The total yield was $13,380 in gold, 205,974 ounces of silver, 1,114,085 pounds of copper, 3,528,134 pounds of lead, and 656,457 pounds of zinc recovered as spelter, aggregating in value $452,476. Of this amount, $331,513 was the value of the crude shipping ore, which averaged $29.77 per ton. The Horn Silver mine yielded shipping grade ores of lead, copper, and zinc. Tintic and Salt Lake smelters purchased the lead and copper ores, the zinc ore going to Colorado; and the ore of milling grade, aggregating 8,000 tons, was broken and stored in the mine awaiting the decision of the company directors to remodel the reduction plant on the property. Operations of ore extraction were confined to several places from the 400-foot level down to the 900-foot level. In 1909 ore assaying about 3 per cent of copper and low in silver was discovered in quite a large body on the 750-foot north level. At present this ore can not be profitably handled. The lead sulphide and the carbonate ore shipped by the company aggregated 7,453 dry tons, and carried from 0.02 to 0.19 of an ounce of gold per ton, 7 to 43 ounces of silver, 3.5 to 28 per cent of lead, and below the quantity of copper paid for by smelters, averaging about 0.5 per cent. Copper lead ore, of which 946 tons were shipped, contained per ton 0.03 to 0.05 of an ounce of gold, 7.75 to 11.85 ounces of silver, 5.30 to 15.85 per cent of lead, and 4.24 to 15.6 per cent of copper: zinc sulphide ore, 1,222 tons in quantity, contained 0.03 to 0.045 of an ounce of gold, 7.05 to 14.6 ounces of silver, 12.7 to 17.35 per cent lead, 31.1 to 37.6 per cent zinc Lessees forwarded to the smelters 1,070 tons of lead ore, some of it containing as high as 0.07 of an ounce of gold, 22.2 ounces of silver, 32.2 per cent lead, and 9.84 per cent copper.

The company working the Cactus mine was reorganized the latter part of 1909, expecting to resume operations the first part of 1910. Production of copper ore and concentrate ceased March 1, and from that time to the close of the year the mill was overhauled with a view of increasing its efficiency. Ore exposed in the mine was reported to be 1,127,083 tons, averaging 1.8 per cent copper. Other estimates are given for probable and partly developed ore by the company's engineer. The Blackbird mine, adjoining the Cactus, was being developed with a core drill.

From the King David property, adjoining the Horn Silver mine on the west, 1 car of silver lead ore was sorted by lessees and shipped. To the north of Frisco the Gold Reef property yielded lead ore containing gold and a trace of silver. Several shipments of lead ore were made from the Beaver Carbonate mine, which was reopened in 1908. The ore was mined from a deposit said to be 30 feet wide and about 100 feet long, found 640 feet east of the shaft on the 700-foot level. Lessees of the old dumps produced and shipped lead concentrate produced in a small milling plant erected on the property.

Star district.—Mine operators of deep mines in the northern and southern parts of the Star district reported the shipment of 4,343 tons of ore to smelters in 1909, yielding $811 in gold, 67,098 ounces of silver, 129,449 pounds of copper, and 2,198,484 pounds of lead, aggregating $147,065, at an average value of $33.86 per ton. Zinc silicate ore was shipped from the Cedar Talisman mine in 1908, but none in 1909, though some was mined and placed on the dumps. The gold yield of 1909 from ores of the district was less than half of that of 1908; but production of silver, copper, and lead increased. The principal mines producing were the Red Warrior, Moscow, Cedar Talisman, Harrington, and Lydia. Each mine yielded lead ore, the first two doubling their lead output from richer ores mined.

BOXELDER COUNTY.

Lucin district.—The Copper Mountain mine doubled its output of copper in 1909 over that shipped in 1908. Shipments continued to the Garfield smelter.

Park Valley district.—Shipments of gold bullion and crude ore were made to Salt Lake from the Susannah mine.

Sierra Madre district.—Development was active in this district in 1909.

GARFIELD COUNTY.

Colorado River or White Canyon district.—No reports of production were recorded from this region in 1909. Several of the most promising placer properties are under development.

GRAND COUNTY.

La Sal district.—One surface and 2 deep mines yielded a production in 1909. The gold output was valued at $2,000. The output does not all enter into the State total for the reason that some of the gold produced was not reported until too late for tabulation. Copper ore was shipped from the High Ore and the Blue Jay properties and the principal development work of the district was performed on the Boston and Utah properties. Some siliceous gold ore was milled from the Eureka and Point Lookout group, and bullion was also produced by sluicing methods from the surface of several properties. Operators at Wilson Mesa have lost by the sluicing method much of the gold contained in the partly disintegrated angular fragments of quartz, and will try a milling process. Gold is said to have been found on the Wilson Mesa over an area of 20 square miles. The material tested is largely crumbled quartz and porphyry bowlders. Shafts sunk 80 feet on the mesa have not reached the solid formation.

IRON COUNTY.

Gold Springs district.—The production of gold and silver in 1909 was but a fifth as great as in 1908, because of the partial idleness of the Jennie mine, whose mill is to be changed to operate with electrical equipment.

Stateline district.—Lessees working old dumps in the district shipped one car of gold and silver ore in 1909.

JUAB COUNTY.

Detroit (Drum) district.—The Detroit district is situated 35 miles west of Oasis, and is credited with shipments of high-grade copper ore, mined from the Keystone claim of the Ibex group. The main workings of the Ibex mine, which have reached a depth of 570 feet, are some distance from the Keystone claims where the new strike was made.

Fish Springs district.—Three operators of deep mines made shipments of lead-silver ore. The principal part of the output in 1909 came from the Utah mine, which now includes the Last Chance property. At no time in the history of the property has it been possible to block out considerable bodies of lead ore, which occurs in small deposits in the limestone, usually connected, at times some distance apart, but having a well-defined trend.

Mount Nebo district.—The Nebo Star and Nephi properties produced ore, which carried values principally in lead.

Tintic district.—The decrease in the number of producers from 42 in 1908 to 37 in 1909 did not decrease the output of the Tintic district, but instead a remarkable increase is shown in the following table:

Mine production of gold, silver, and associated metals in the Tintic district, Juab and Utah Counties, Utah, in 1908 and 1909, with increase.

Metal.	1908.		1909.		Increase.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold..............fine ounces..	63, 248. 57	$1, 307, 464	83, 189. 47	$1, 719, 679	19, 940. 90	$412, 215
Silver..................do....	4, 118, 440	2, 182, 773	6, 404, 847	3, 330, 520	2, 286, 407	1, 147, 747
Copper................pounds..	5, 707, 786	753, 427	5, 915, 669	769, 037	207, 883	15, 610
Lead....................do....	25, 045, 882	1, 051, 927	56, 502, 209	2, 429, 595	31, 456, 327	1, 377, 668
Total..................	....	5, 295, 591	....	8, 248, 831	....	2, 953, 240

Nearly all of the ore mined in 1909 at Tintic, 256,578 tons, valued at $8,212,835, with an average of $32.01 per ton for the gold, silver, copper, and lead, was shipped to the smelters at Silver City and the plants near Salt Lake City. In addition, 3,526 tons of ore, valued at

$35,996, with an average value of $10.21 per ton for gold, silver, and lead, were concentrated at one mill and a concentrate consisting principally of lead carbonate was produced. The ore output of the district in 1909 was a normal one which has been maintained each year since 1904, except when the financial panic of 1907 had the effect of decreasing mining operations and output in 1908. The metal output increased in value from $5,295,591 in 1908 to $8,248,831 in 1909, the tonnage of ore mined from 172,582 tons to 260,104 tons, and the average value per ton from $30.68 to $31.71. The increase in tonnage held good for each kind of ore, except copper-lead ore. The different kinds of ore produced in the district in 1909 yielded as follows:

Mine production of Tintic district, Juab and Utah Counties, in 1909, by kinds of ore.

Kind of ore.	Quantity of ore.	Gold.	Silver.	Copper.	Lead.
	Short tons.	*Fine ounces.*	*Fine ounces.*	*Pounds.*	*Pounds.*
Siliceous	11,310	7,037.29	263,164	262,932	273,908
Copper	119,480	50,349.81	1,447,909	5,465,996	1,537,211
Lead	128,258	25,801.07	4,692,520	183,287	54,686,132
Copper-lead	46	1.29	1,254	3,454	4,958
Total	260,104	83,189.46	6,404,847	5,915,669	56,502,209

No zinc ore was reported. The Tintic district embraces territory on the boundary line of Juab and Utah Counties. It is of interest to show the output for each side of the line, especially since the production of the east side in Utah County was nearly as important as in Juab County, though from fewer mines, and was as follows:

Division of Tintic district metallic output in 1909, by counties.

County.	Number of mines.	Quantity of ore.	Gold.	Silver.	Copper.	Lead.	Total value.
		Short tons.	*Fine ounces.*	*Fine ounces.*	*Pounds.*	*Pounds.*	
Juab	28	182,315	69,947.92	3,449,033	5,898,382	20,691,924	$4,895,992
Utah	9	77,789	13,241.54	2,955,814	17,287	35,810,285	3,352,839

The production of the Iron Blossom mine is credited to Juab County for the reason that the largest part of its mineral acreage is in that county. The mines producing in 1909 over 2,000 tons of ore containing gold, silver, copper, and lead, named in order of their importance, were as follows: Centennial-Eureka, Colorado, Iron Blossom, Sioux, Mammoth, May Day, Grand Central, Uncle Sam, Victoria, Beck Tunnel, Bullion Beck and Champion, Ajax, Eagle and Blue Bell, Eureka Hill, Gemini, and Yankee. Other properties producing were the Swansea Consolidated, Chief Consolidated, Opohongo, East Tintic Development, and the Ridge and Valley.

At Silver City a new ore-sampling mill, erected by Taylor & Brunton, was finished in April. It is said to have a capacity for sampling 20,000 tons of ore per month. The Tintic smelting plant, which was blown in in August, 1908, and closed down after a brief and unsatisfactory run, was started again in October of that year and operated almost continuously until October, 1909. There are

4 lead furnaces in the plant and 1 copper furnace, which was operated only a short time. The lime and iron for flux were supplied from nearby mines of the smelting company, and as the ores of the district are of a siliceous nature, fluxing conditions were ideal. Coke was shipped from Sunnyside, Utah. An average of 15 different slag samples taken at random is reported to have shown a loss of 1.7 ounces of silver and 0.7 per cent of lead per ton. The Eureka Hill Railway, completed in 1908 to operate between the mines on the east side of the district and the smelter, is a great benefit to all the mines accessible to the line.

At the Centennial-Eureka mine prospecting was carried on with the usual vigor and with the usual satisfactory results. A moderate flow of water was encountered at 2,200 feet in the shaft almost exactly at the point at which it was expected, and in agreement with the water level disclosed in neighboring mines. A pumping plant is now in progress of construction. A tunnel 2,160 feet long was run from a point on the railway tracks to the shaft, connecting with the latter just below the 500-foot level. This tunnel will carry off the water raised by the pumps and will also be used for haulage, delivering the ore directly to the railroad cars, eliminating the use of the aerial tramway, and reducing the hoisting of ore and pump water. The shipments of ore from this mine during 1909 amounted to 109,430 tons.

On the Bullion Beck and Champion mine, of which the United States Mining Company owns the control, a limited amount of development work was carried on.

The Little Chief mine was acquired by a new company, now known as the Chief Consolidated, which controls, in addition to its main property, nearly all the town site embraced by the city of Eureka, under which valuable ore is expected to be found. The property has but one vertical shaft on the Little Chief claim, now 1,675 feet deep, which is being continued to 1,800 feet. The shaft is sunk in nonmineralized ground from which crosscuts about 450 feet to the ore channel have been driven. Several hundred tons of lead-silver ore with slight gold values have been mined and shipped from the 1,000-foot level. The first good body of ore was found on the 1,400-foot level late in 1909. Similar ore is expected to be developed above and below the new find. Gold and silver contentof the ore is reported to have increased in depth and lead to have given way to copper in the lower levels.

From the Dragon iron mine, 1,355 cars, aggregating 28,000 tons of brown hematite, were shipped in 1909, carrying an average of 51.75 per cent of excess of iron over the silica content. Nearly all the ore was used at the Tintic smelter for flux. The mine attracts considerable interest since the exploratory work is being advanced with diamond drills, with which it is possible to prospect the property to a depth of 800 feet. Development of the low-grade silver-lead fissures containing copper, lead, gold, and silver on the 600-foot level adds interest to the mine. Shipments of iron ore began to the Salt Lake smelters during the latter part of the year.

Ore shipments of some magnitude began in 1906 and continued for two years from the Beck Tunnel mine, in which was found a deposit of mixed lead-silver carbonate and sulphide ore. During 1907 ore of similar character was discovered and shipped from the Colorado mine, the next property to the south, which, in 1909, was the largest lead producer of the district. Adjoining the Colorado on the south, is the Phoebe claim of the Sioux Consolidated mines, which began in 1908 to yield the same kind of ore as the other two mines. In 1909 the Iron Blossom, still farther south and adjoining the Sioux, produced a large tonnage of similar ore. The collars of the shafts of the Beck Tunnel, and of the Colorado, Sioux, and Iron Blossom mines are located on about the same general contour level of 7,000 feet, and in sinking on this north-south zone the ore was encountered in the Beck Tunnel mine at 300 feet; on the Colorado, at 250 feet; on the Sioux, at 400 feet; and on the Iron Blossom at 380 feet. The ore channel is reliably reported to have been proven on its strike through these properties for a distance of 4,100 feet. From the discovery of the first ore in 1905, when a few hundred tons were shipped, until the end of 1909, this ore channel yielded with comparatively little waste rock, 146,805 tons of shipping ore, which contained 27,914.85 ounces of gold, 6,824,842 ounces of silver, 19,943 pounds of copper, and 74,918,519 pounds of lead. These metals at each year's average prices give a total value to the product of $8,273,943, an average value per ton of $56.36. Dividends were paid from the total output amounting to $3,915,024.

The Ajax, Cleveland, Pedro, and Golden Chain groups of claims were consolidated and are to be operated under the name of the Golden Chain mines. On the Ajax property the shaft is sunk to a depth of 1,100 feet, and its deep workings and good equipment will enable the operators to accomplish speedy development of the entire estate. A considerable tonnage of copper ore was shipped from the Ajax during 1909 from the upper drifts, but up to the close of the year nothing of importance had been encountered in the deeper workings.

In the Eagle and Blue Bell mine a new lead-ore deposit was encountered while sinking a winze from the 1,000-foot level, and, in drifting, the ore was found again with a pronounced dip to the west. The ore is reported to carry a lower percentage of lead than other ore found in the mine, but its values are higher in silver and gold. The shaft, at the close of 1909, was 1,100 feet deep.

Only a few lessees were working the Eureka Hill mine during 1909, and but little ore was reported as coming from below the 600-foot level.

In the Gemini mine, work was successfully carried on to 1,900 feet in depth, the deepest level in the district. A large electric pump, the first used in the district, was installed in 1908. The management reported that the sulphide ore encountered in the lower workings showed an appreciable increase in the percentage of copper to the lead and silver.

On the 2,100-foot level of the Grand Central mine a new ore deposit was reported to have been opened up in 1909 and again found on the upper levels. Shipments of copper and lead ore, carrying gold and silver, were made during 1909.

The Opex shaft was sunk to 2,200 feet. At 2,180 feet a drift was driven north and south, prospecting for the Centennial-Eureka fissure. In December the drift was nearing the side line of that property.

A late ore find in the Uncle Sam mine showed 7 feet of ore assaying 30 per cent of lead and 30 ounces of silver and $3.60 in gold per ton.

The Opohongo mine workings were opened to a vertical depth of 700 feet and are reached through the Black Jack shaft from the 300-foot level. Ore shipments began in 1909, aggregating 28 carloads.

The ore yielded from 8 to 15 per cent copper and 9 to 20 ounces of silver and $1 to $12 in gold per ton.

The shaft of the May Day mine reached the 1,100-foot level and drifting toward the ore shoot found on the 1,000-foot level was started the latter part of 1909. Lead sulphides and carbonates averaging 41 per cent lead and 27 ounces of silver per ton were shipped from the 1,000-foot level during 1909.

The East Tintic Development Company was the only ore shipper from the extreme eastern part of the district. On the 230-foot level carbonate and sulphide lead ores were followed for 110 feet. About 740 tons have been shipped from the stope between the 130-foot and 230-foot levels. This mine is in the vicinity of the Standard and Montana properties, which are being vigorously developed.

At the Mammoth mine a new ore body found on the 2,100-foot level was developed. Besides the company ore taken out, much ore was mined by lessees, who have been working in the old stopes. A car of siliceous gold ore, shipped during the year to a refinery in the East, contained 111 ounces of gold and 27 ounces of silver per ton. Other shipments of ore made to local smelters carried lead and copper in addition to the gold and silver.

Operators of the Swansea mines, in the porphyry zone, prepared for deepening the South Swansea shaft from 865 feet to 1,000 feet, but owing to a heavier flow of water than could be handled economically the development was discontinued. Lessees mined ore of shipping grade on the 400-foot and 600-foot levels.

Development of the Lower Mammoth mine was confined entirely to sinking the two-compartment shaft to 2,000 feet and crosscutting to the veins on the different levels above. Some difficulty was encountered in breaking the station on the 2,000-foot level, owing to water being met just below the 1,900-foot level. The formation is a highly siliceous stratified lime with soft gouge between the strata, which break off on exposure. In consequence, timbering was necessary at this station, the only station in the mine requiring it. Further than this, water has not been troublesome. The usual ore shipped is a brown, iron-stained, spongy material, containing small quantities of gold, 24 ounces of silver per ton, and 15 per cent of lead and some copper. The ore carries from 14 to 21 per cent of moisture.

According to the company's annual statement, the Yankee mine was developed in 1909 from the 1,000-foot shaft and from its adit level, with the object of finding the Beck-Tunnel Colorado vein. Developments made have revealed in the first 500 feet from the west-side line of the property, three parallel ore channels striking north and south, each successive one to the east being lower in elevation than its predecessor. These ore channels followed the contour of the hill. In the development of the third and lower channel, the Beck-Tunnel Colorado vein is said to have been discovered, and work was directed toward this territory on the 300-foot, 400-foot, and 500-foot levels. On the 350-foot intermediate level and in the area embraced by the Bryan claim in the Humbug draw the ground was found highly mineralized about 300 feet north of the most northerly discovered ore in Beck Tunnel territory. Ore shipments, containing gold, silver, and lead, from the older parts of the mine were made by the company and lessees to a smelter in Colorado.

The Iron King property, nearly 2 miles north of the Dragon Iron mine, shows at its surface extensive iron croppings which were being developed by an adit over 1,700 feet in length in 1909, with several hundred feet to be driven before shipments of the iron ore will be made to the smelters, where it is in demand as flux. The property is receiving development at another point by shaft, which was sunk vertically 1,400 feet.

The vertical 2-compartment shaft of the Tintic Standard mine, situated near the East Tintic mine, in the eastern part of the district, reached the 700-foot level and was in siliceous rock. A southeast drift from this level cut a 3½-foot fissure, in which barite was found with the vein matter which assayed $15 in gold and contained high values in silver. Occasionally lead carbonates are found in the fissures or at the contact of a highly silicified lime rock and the limestone.

West Tintic district.—The Scotia and the Boston-Tintic mines were producers of a shipping grade of lead ore.

MILLARD COUNTY.

A small production of lead ore, containing about 1 ounce of silver per ton, was shipped from the Century claim, about 9 miles from Goss. Development of mining property on Antelope Point Mountain, about 9 miles southeast of Black Rock, resulted in developing ore which assayed about 11 to 12 per cent of lead and 8 to 20 ounces of silver and $2.50 to $5 in gold per ton.

MORGAN COUNTY.

Argenta district.—Several companies have developed mining property during 1909, but the only shipments of ore were made from the Carbonate Hill mine. The ore contains gold, silver, and lead.

PIUTE COUNTY.

Gold Mountain district.—No production was recorded from the Annie Laurie mine, which was practically idle. Work was performed principally on the Sevier, Advocate, Signal Peak, Lone Tree, and Golden Treasure properties.

Mount Baldy district.—The Deer Trail mine was under development and a large tonnage of gold quartz was said to be blocked out.

Ohio district.—Developments at several properties in this district have been carried on for a number of years. Ore shipments were recorded for the Shamrock and the Glenn Erie properties, producing copper ore containing gold and silver.

SALT LAKE COUNTY.

Big and Little Cottonwood districts.—The number of mines operating each year and the production of ore and its content in the Big and Little Cottonwood districts for five years were as follows:

Number of mines producing in Big and Little Cottonwood districts, and total tons of ore sold or treated in 1905–1909, and total content of gold, silver, and associated metals.

Year.	Number of mines producing.	Tonnage.	Gold.	Silver.	Copper.	Lead.	Total value.
		Short tons.	*Fine ounces.*	*Fine ounces.*	*Pounds.*	*Pounds.*	
1905	6	26,003	950.00	371,683	811,639	1,702,258	$450,756
1906	10	20,801	762.07	345,102	1,193,743	1,922,276	586,933
1907	11	19,896	976.93	399,417	1,074,238	2,337,924	622,568
1908	21	5,866	321.35	63,246	269,212	603,840	101,061
1909	15	13,208	335.72	158,867	1,842,711	332,475	343,400

About one-sixth of the ore mined in 1909 was concentrated, and yielded 590 tons of concentrate, 14.61 ounces of gold, 9,999 ounces of silver, 95,076 pounds of copper, and 81,603 pounds of lead, with a total value of $21,371, or an average value per ton of $36.22. The remainder of the output of the two districts was crude ore shipped direct to smelters, aggregating 10,965 tons, which contained 321.11 ounces of gold, 148,868 ounces of silver, 1,747,635 pounds of copper, and 250,872 pounds of lead, with a total value of $322,029, and an average value per ton of $29.38. The ore occurrences are mainly replacement deposits in limestone. Of the different kinds of ore mined in the region, one mine yielded 10 tons of high-grade siliceous ore, containing a small quantity of silver and copper. The largest part of the total ore output, 12,150 tons in quantity, containing 272.41 ounces of gold, 131,385 ounces of silver, 1,723,166 pounds of copper, and 88,341 pounds of lead, was classed as copper ore. Some of the copper ore, especially that containing the higher percentage of lead, was shipped to lead furnaces, and part of it, containing lead, was smelted at copper plants, at which the lead content was not recovered and was eliminated from the figures of production. The lead ores produced, 191 tons in quantity, yielded 6.41 ounces of gold, 5,406 ounces of silver, 6,521 pounds of copper, and 95,921 pounds of lead. Of copper-lead ores, 857 tons were shipped, yielding 39.11 ounces of gold, 22,067 ounces of silver, 112,790 pounds of copper, and 148,213 pounds of lead.

On the Big Cottonwood side of the divide the mines producing in 1909 were the Maxfield, Iowa-Copper, Prince of Wales, Wasatch-Utah, and Big Mitt. Near Alta, on Little Cottonwood Creek, the Columbus Consolidated, Alta and Hecla, South Columbus, East Columbus, and City Rocks were producers, and ore shipments were made from several other properties worked by lessees.

West Mountain or Bingham district.—The record for the largest tonnage of ore mined in the State was held by this district.

Production of gold, silver, and associated metals in the West Mountain or Bingham district, Salt Lake County, Utah, in 1908 and 1909.

Metal.	1908.		1909.		Increase.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold.............fine ounces..	60.382.69	$1,248,221	7,359,947	$1,521,436	1,321,678	$273,215
Silver.............do....	1,053,146	558,168	1,615,394	840,005	562,248	281,837
Copper.............pounds..	71,155.740	9,392.558	92.560,340	12,032,844	21,404,600	2,640,286
Lead.............do....	15.169,518	637,120	30,365,819	1,305,730	15,196,301	668,610
Zinc.............do....	....	....	649,542	35,075	649,542	35,075
Total............	....	11,836,067	....	15,735,090	....	3,899,023

For the last five years the output has been increasing, as shown by the following table:

Number of mines producing and total tons of ore sold or treated in West Mountain or Bingham district in 1905–1909, and total content of gold, silver, and associated metals.

Year.	Number of mines producing.	Tonnage.	Gold.	Silver.	Copper.	Lead.	Zinc.	Total value.
		Short tons.	*Fine ounces.*	*Fine ounces.*	*Pounds.*	*Pounds.*	*Pounds.*	
1905	21	1,012,009	63,701.00	1,980,583	39,219,734	23,494,879	....	$9,735,627
1906	25	996,121	78,986.03	1,927,350	39,424,276	22,927,661	....	11,839,873
1907	29	1,503,082	75,730.24	1,786,580	45,431,964	21,971,064	....	12,995,485
1908	27	2,691,640	60,382.69	1,053,146	71,155,740	15,169,518	....	11,836,067
1909	24	4,166,992	73,599.47	1,615,394	92,560,340	30,365,819	649,542	15,735,090

Copper and lead sulphide ores of shipping grade increased from 540,391 tons in 1908 to 626,068 tons in 1909, which was about one-fifth less than in 1907. The ore shipped to smelters in 1909 yielded 45,668.60 ounces of gold, 1,037,339 ounces of silver, 24,289,451 pounds of copper, and 11,189,428 pounds of lead. Ores concentrated increased from 2,151,249 tons in 1908 to 3,540,563 in 1909. Concentrates produced from ore milled in 1909 aggregated 196,485 tons, as against 113,023 tons in 1908 and 50,115 tons in 1907. The metallic yield of concentrates shipped to smelters in 1909 was 27,923.81 ounces of gold, 578,050 ounces of silver, 68,270,889 pounds of copper, 19,176,391 pounds of lead, and 649,542 pounds of zinc. Included with these concentrates were those resulting from the treatment of 360 tons of tailings from mills on Carr Fork Creek. The zinc produced was from 1 mine in the district and was shipped to an eastern refinery. Other mines were preparing to ship ores containing zinc in 1910. There was but one shipper of gold bullion, the yield of sorted ore mined from small veins occurring in igneous intrusive rocks of the southern part of the district. No placer production was reported. The production of different kinds of ore in 1909 is given in the table following:

Output of ore and production of metals in Bingham district, Utah, in 1909, by kinds.

Kind of ore.	Number of mines producing.	Tonnage.	Gold.	Silver.	Copper.	Lead.	Zinc.
		Short tons.	*Fine ounces.*	*Fine ounces.*	*Pounds.*	*Pounds.*	*Pounds.*
Siliceous ore	2	8,102	1,332.38	94,760	31,935	59,390	....
Copper ore	9	4,012,438	66,285.12	902,461	90,920,539	11,092	....
Lead ore	16	146,452	5,981.96	618,173	1,607,866	30,295,337	649,542
Total	27	4,166,992	73,599.47	1,615,394	92,560,340	30,365,819	649,542

Siliceous ore was produced from 2 mines, yielding 8,102 tons in 1909, against 3 mines producing 2,412 tons in 1908. Copper ore was the output of 9 mines, producing 4,012,438 tons in 1909 against 2,633,378 tons from 8 mines in 1908. Lead ore, from 16 mines, aggregated 146,452 tons in 1909 against 56,112 tons produced by 16 mines in 1908. One mine in 1908 produced 189 tons of copper-lead ore, but none was reported in 1909.

The output of disseminated copper ore from monzonite porphyry constituted 82.1 per cent of the total tonnage of the district and was the source of 72.8 per cent of the copper, 31.8 per cent of the gold, and 13.8 per cent of the silver recovered. The monzonite ore mined chiefly for its copper by steam shovels was hauled from the mines 15 miles to Garfield and concentrated in the large mills erected there by the Utah Copper and Boston Consolidated companies. Part of the tonnage was treated at the Copperton concentration mill, situated at the lower end of Bingham Canyon and owned by the former company. Preparations were made for the treatment of monzonite porphyry ore from the Ohio copper mine at its new concentration mill situated at Lark. The first unit of the plant began operations in December, but it was reported that no shipments of concentrate were made in 1909.

The sulphide copper ores in limestone replacements, amounting to 13.7 per cent of the district tonnage, produced 55.4 per cent of the gold, 37.7 per cent of the silver, and 23.8 per cent of the copper. The lead ores, also mainly sulphide, forming 4.2 per cent of the district tonnage, were the source of 12.8 per cent of the gold, 48.5 per cent of the silver, and 3.4 per cent of the copper.

Producers of the district, mining, in 1909, 5,000 tons or over, named in order of production, were as follows: Utah Copper, Boston Consolidated, Highland Boy, Yampa, United States, Utah Apex, Bingham-New Haven, Dalton & Lark, Commercial, and New England.

In its annual statement, the Utah Copper Company reports 90,000,000 tons of developed and partially developed ore. The additional areas developed during 1909 were of a somewhat lower grade than those previously mined, but the average assay of these lower grade ores and of the better grades combined showed the copper content to be 1.75 per cent. During 1909 the underground development, consisting of tunnels, drifts, and raises, amounted to approximately 24,000 feet. A large percentage of the underground work has been destroyed by surface operations and underground mining, the result being that in 1909 there was in existence only about 24 miles of open underground work, and a portion of this was not accessible as a result of heavy blasting in connection with the stripping operations. The quantity of ore mined by underground methods has been gradually decreasing, and by the end of 1909 this method of mining was practically discontinued. The averages for the entire year were 13 per cent of underground ore and 87 per cent of steam-shovel ore. During 1909 3 steam shovels were added, making 11 in operation. Both the Magna and the Copperton concentration plants were in continuous operation, although neither of them could be operated at full capacity, except for short periods. The total production by the two concentrating plants of copper contained in concentrate, was 54,472,845 pounds; the resulting net production, after smelter allowances and deductions were made, was 51,749,233 pounds. The concentrate also yielded 20,862 ounces of gold and 198,943 ounces of silver, after smelter deductions on silver. The average grade of concentrate for the year was approximately 26 per cent of copper. The average price received for copper sold during the period was 12.915 cents per pound. The average cost per pound of copper produced, based on the net pounds of copper resulting after smelter deductions and allowances were made, was 8.787 cents per pound, this cost including all expenses of smelting concentrate and the refining, transportation, and disposition of the metal. The average total cost of mining and milling, exclusive of transportation and smelting charges, was 94.43 cents per ton of ore treated. Included in this cost was a charge of 9¼ cents per ton, which covered all underground development costs at the mine, and a proper proportion of stripping expense.

The acquisition of the property of the Boston Consolidated Mining Company, since the expiration of 1909, has resulted in an increase of 379 acres in the mining property owned by the Utah Copper Company, bringing the total area up to 580 acres of contiguous mining claims. The milling plant, near Garfield, acquired through this consolidation and hereafter to be known as the Arthur plant, had a nominal capacity of 3,000 tons per day, and is to be changed to a capacity of at least 6,000 tons per day. It is to be modeled after the Utah Copper Company mill, which is now known as the Magna plant and which had in 1909 a regular capacity of from 10,000 tons to 12,000 tons of ore per day. By rearranging the rough concentration and classification system, the enlargement of the plants from the capacity for which they were originally designed, has been made possible.

Shortly following the close of 1909, the property of the Boston Consolidated Company was consolidated with that of the Utah Copper Company, and, according to the annual statement of the former company, its mine produced during its fiscal year ending September 30, 1909, from the sulphide zone, 69,375 dry tons of ore, containing 5,823.41 ounces of gold, 68,524.89 ounces of silver, and 3,237,959 pounds of copper. After deducting smelting and refining losses, there remained 3,004,115 net pounds of copper, which cost, after crediting gold and silver values, 10.96 cents per pound delivered at New York City. The average cost of mining for this ore for the year was $1.66 per ton, making a total cost of $2.22 per ton. From the porphyry mine the ore averaged 5.39 per cent moisture. There were mined 645,679 dry tons of ore from the development of drifts and raises required to establish the caving system. On account of the extraordinary developments, the mining cost averaged 76.19 cents per ton, which is considered abnormal, since it was possible to mine the ore the last two months of the year for an average cost of 66.51 cents per ton. The mill product was 32,961 tons of concentrate, which, on shipment to the Garfield smelter, yielded 2,141.48 ounces of gold, 20,801.38 ounces of silver, and 13,446,316 pounds of copper. With smelting and refining deductions, there remained 12,539,067 net pounds of copper, which cost, with all charges added, 11.16 cents per pound delivered at New York. Thirteen sections, comprising the complete concentration mill, were in operation in July, 1909.

At the Highland Boy mine developments were not as satisfactory in 1909 as in previous years. According to the annual statement issued by the Utah Consolidated Company, the grade of the ore mined in 1909 was the lowest in the history of the property. Shipments of sulphide copper ore were made to the Garfield smelter, aggregating 280,637 tons, which yielded 10,043,000 pounds of copper, 298,167.33 ounces of silver, and 21,569.09 ounces of gold. Each of the levels from the fourth to and including the ninth, furnished nearly equal quantities of ore. The lowest amount was mined from the upper or fourth level. In 1910 the ore of this mine was to be transported by aerial tramway to the International smelter at Tooele. The tram line was nearly completed and will be about 4 miles long, with a capacity of 100 tons of ore an hour, at an estimated cost of 15 cents per ton.

The Old Jordan, Galena, and Telegraph mines are controlled by the United States Mining Company, which, in its annual statement for 1909, announced a sufficient tonnage of ore in sight to insure regular shipments, on the present scale, for a number of years with very little exploration work necessary. Ore mined and shipped to its Midvale smelter aggregated 79,676 tons of gold-silver-lead-zinc ore. An additional small tonnage was mined by lessees. The value of the ore was considerably enhanced by the introduction, in the concentration mill near the smelter, of the Huff electrostatic process of separation. By this process the zinc contained in the ore is separated and made to yield a revenue. Before this the zinc was not only a total loss, but it added, on account of its refractory nature, materially to the difficulty and cost of smelting.

The Utah-Apex mines, according to the annual statement for the company's fiscal year to September 1, 1909, yielded 23,872 tons of mill ores and 9,535 tons of shipping grade lead sulphide ore. In unmined ore reserves an estimate gave 61,000 tons of mill ore with an average assay per ton of 5.13 ounces of silver and 12.8 per cent of lead, 1.7 per cent of copper, 8.47 per cent of iron, and 55 per cent of silica. Of shipping grade lead ore, 19,300 tons were measured, assaying an average per ton of 11 ounces of silver and 37 per cent of lead, 1.8 per cent of copper, 9 per cent of iron, and 24 per cent of silica. The largest ore bodies occur between a quartzite-lime contact at intersection of fissures. In December, 1908, the Phœnix mine and concentration mill were taken under control by the Utah-Apex management and during 1909 the mill operated on ores from both mines. Its Markham concentration mill was closed and sold to a company treating the ores of the Red Wing, Butler Liberal, and several other mines consolidated under the name of the North-Utah Mining Company.

The Commercial and Dalton & Lark mines are the property of the Bingham Mines Company. In June, 1909, work at the Commercial mine was resumed after the mine had been idle since the fall of 1907, when the company then owning the mine was compelled by the courts to close its smelter. Shipments of copper iron sulphides, carrying gold and silver, were made to the Yampa smelter. Sixty-two acres of mineral land embrace the claims, which are in the limestone and quartzite and are cut by occasional porphyry dykes and porphyry intrusions. The ore produced is a replacement of the limestone. Two adits 1,100 feet and 1,700 feet long, respectively, are driven to intersect the ore bodies, and an incline shaft in ore has been sunk 330 feet from the level of the lower adit. The Dalton & Lark mine embraces several groups, situated on the eastern slope of the Oquirrh range, comprising an area of 240 acres. These groups have 3 parallel beds of limestone, varying in horizontal thickness from 10 to 480 feet, alternated with belts of quartzite. These strata of limestone and quartzite are intersected by numerous cross fissures, but there is less evidence of faulting in this portion of the district than farther west. Porphyry intrusions and porphyry dikes are numerous. The shipping product of the several veins of this group has been copper ore, silver-lead ore, and copper-lead ore, usually occurring in distinct bodies and permitting the shipment of each product separately. In 1909 there was a large tonnage of low-grade ore developed, which it was proposed to mine and treat in the Ohio Copper concentration mill, located near the portal of the Mascotte adit. The richest lead ore produced is said to have come from the Lark-Yosemite body in a narrow bed of limestone from a few inches to 20 feet in thickness, lying between quartzite walls. The shoots of ore vary in length from 500 to 1,300 feet, and in places so completely replace the limestone that in early operations of the vein it was supposed to be a fissure in the quartzite. The Mascotte drainage and transportation adit, which has been driven west 7,500 feet from near Lark on the west side of Salt Lake valley to the Lark-Yosemite vein, continues and develops the Lark, Brooklyn, and Lead mine veins. The adit is being extended and was in 1909 approximately 3 miles from its portal and headed for the Ohio-Copper mine shaft.

SUMMIT AND WASATCH COUNTIES.

The Park City region, embracing territory in both counties, yielded from its mines an increased quantity of silver, copper, lead, and zinc in 1909. The metallic production of the region in 1908 and 1909 is shown in the following table:

Mine production of gold, silver, and associated metals in Park City mining region, Summit and Wasatch counties, Utah, in 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold..............fine ounces..	5,083.34	$105,082	4,814.18	$99,518	− 269.16	− $5,564
Silver....................do....	2,463,735	1,305,779	2,825,385	1,469,201	+ 361,650	+ 163,422
Copper...............pounds..	541,061	71,420	1,655,749	215,247	+1,114,688	+ 143,827
Lead......................do....	34,051,699	1,430,171	46,350,390	1,993,067	+12,298,691	+ 562,896
Zinc......................do....	1,405,652	66,066	6,737,237	363,811	+5,331,585	+ 297,745
Total..................	....	2,978,518	....	4,140,844	....	+1,162,326

Blue Ledge, Snake Creek, and Uinta districts are included in the region, where 18 mines showed a record of 196,172 tons of ore mined in 1909, against 11 producers mining 142,331 tons of ore in 1908. In 1907 there were 15 operators, mining 235,628 tons of ore. From a total average value in 1908 of $20.93 per ton for the gold, silver, copper, lead, and zinc contained in the ore, the value per ton increased to $21.11 in 1909. The gold and silver value per ton decreased from $9.91 in 1908 to $8 in 1909. The greater part of the ore mined in 1909 came from replacement deposits in limestone and from the Ontario fissure in quartzite. Ore of shipping grade, aggregating 42,710 tons, was mixed carbonate and sulphide of lead. The remainder of the ore, 145,297 tons, and 8,165 tons of old tailings, were treated at concentration mills and yielded 49,994 tons of concentrates, containing 2,066.17 ounces of gold, 1,008,963 ounces of silver, 389,480 pounds of copper, 21,012,967 pounds of lead, and 6,737,237 pounds of zinc, with a total value of $1,885,374, and an average value of $37.71 per ton of concentrates. Crude ore shipped to smelters aggregated 42,710 tons, yielding 2,748.01 ounces of gold, 1,816,422 ounces of silver, 1,266,269 pounds of copper, 25,337,423 pounds of lead, with a total value of $2,255,471 and an average value of $52.81 per ton.

The Silver King Coalition mines produced an average of about 5,900 tons of carbonate and sulphide lead ore per month during 1909. Part of the ore is of milling grade and is treated in the concentration mill on the property. The company is engaged in litigation with its neighbor, the Silver King Consolidated, by whom it is charged with encroaching on the latter company's territory.

A new ore body was reported found in the Andes claim of the Silver King Consolidated mine between the 1,500-foot and 1,600-foot levels. The ore is a mixture of carbonate and sulphide of lead, containing high values in silver. Several fissures have been cut in the development of the property. A shipment of the ore was made to the smelters from the new strike in December. From the incline winze sunk 250 feet from the 700-foot level in the Little Bell mine high-grade silver-lead ore was mined and shipped, beginning in August. Milling tests were made on the low-grade ore.

At the Daly-West mine high-grade milling ore was developed between the 1,550-foot and the 1,800-foot levels, and the 2,100-foot level, which connects with the Ontario drain adit, was extended from the shaft to a point under the ore body. From the upper levels of the mine most of the first and second class shipping ores were mined during 1909. According to its annual statement, the company reports having mined 12,019 tons of shipping ore and 49,534 tons of second-class or mill ore. The ore treated at the mill produced 9,111 tons of lead concentrate and 126 tons of zinc concentrate, the first shipments of which were made to Colorado. The average assay of the crude ore and concentrates shipped in 1909 was as follows:

Average assay of crude ore and concentrates shipped by the Daly-West Mining Company, Utah, in 1909.

	Dry tons.	Gold.	Silver.	Lead.	Copper.	Zinc.	Value per ton.
		Fine ounces per ton.	*Fine ounces per ton.*	*Per cent.*	*Per cent.*	*Per cent.*	
Crude ore	12,019	0.0280	33.98	16.93	1.40	....	$19.02
Lead concentrate	9,111	.0338	38.89	30.57	1.02	....	31.44
Zinc concentrate	126	....	25.00	5.50	....	32.5	....

Ore containing the best zinc content was mined from the 1,700-foot level, and in December, from preparations made for making the new product, 126 tons of zinc concentrate were produced. The equipment for treating an increased tonnage of zinc middling was added to the mill so that in 1910 an important output of zinc might be made by this company.

Development on the 1,200-foot or drain-tunnel level of the Daly-Judge mine was of interest, as it was extended along the Ontario-Daly fissure a distance of 2,518 feet from the shaft and served to ventilate and to a large extent to drain the fissure from above that level. Over 10,000 tons of milling ore were extracted in 1909 from the Ontario-Daly fissure, and 17,119 tons were produced from the bedded deposit along the middle or contact vein on the 1,200-foot level. Milling and shipping ore was mined from the 1,400-foot and 1,500-foot levels, but in greatest quantity from the bedded deposits above the 1,400-foot level. A project was under way to drive an adit from Snake Creek to drain the Daly-Judge mine at a depth of 2,000 feet. The new drainage adit would be about 14,500 feet long when completed. Besides shipping a rich lead-silver concentrate and lead ore to the smelters, the Daly-Judge Company continued its contract with the Grasselli Chemical Company, operating a dry concentration mill near Park City, to treat a 15,000-ton dump of zinc middling. The concentration mill of the Daly-Judge Company treated 47,872 tons of ore in 1909, resulting in the extraction of the products whose quantities and average content are given as follows:

Average metallic content of crude ore and concentrates of Daly-Judge Mining Company, Utah, in 1909.

	Tonnage.	Gold.	Silver.	Lead.	Copper.	Zinc.	Iron.	Value per ton.
	Short tons.	*Fine ounces per ton.*	*Fine ounces per ton.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	
Crude ore	3,437	0.034	31.10	23.00	1.39	13.90	9.03	$23.81
Concentrates	9,243	.059	16.30	32.60	.28	9.40	18.90	24.23
Zinc middling	17,652	.02	4.80	4.00	.00	29.00	14.70	5.85
Iron middling	3,032	.044	8.08	12.90	.27	12.00	26.00	9.06

The American Flag mine attained a depth of 1,135 feet. Work in the lower levels has been prevented for several years by water, but the shaft was drained in 1909 to the 1,100-foot level. Shipments of ore were made during 1909 and extensive developments were in progress.

Ontario-Daly mine lessees shipped during 1909 an important tonnage of ore from above the 600-foot level of both mines.

At the close of 1909 the shaft of the New York Bonanza mine reached 1,000 feet in depth. Drifting toward the ore fissure was accomplished for 85 feet in limestone from the 1,000-foot level. An excessive amount of water was being handled, with serious delay to the developments.

According to report issued by the management of the Wabash mine, its double-compartment vertical shaft was 800 feet deep. In the development of the property four different veins were cut, but without satisfactory results. While a crosscut drift in a southeast direction in the foot-wall country rock in September, 1908, was being driven, a heavy flow of water was encountered and filled up the drift with débris. Fragments of ore found mixed with the material from the water channel assayed 130 to 400 ounces of silver per ton, and about 10 per cent of lead and 2 to 3 per cent of copper. After an ineffectual attempt to lower the water with which the mine rapidly became flooded, the property was closed April 14, 1909.

TOOELE COUNTY.

Gold, silver, copper, lead, and zinc produced from ores mined in Tooele County decreased in total value from $1,563,424 in 1908 to $1,490,096 in 1909. Twenty-three operators in 1908 mined 382,014 tons, whereas 393,725 tons were mined by 24 operators in 1909. The total average recovery value per ton of all the metals decreased from $4.09 in 1908 to $3.78 in 1909, and the gold and silver recovery value averaged per ton from $2.79 in 1908 to $2.45 in 1909. Owing to the restricted operations of the Honerine, Ophir Hill, and Mercur mines the yield of each metal, except zinc, was less in 1909 than in 1908. The gold yield amounted to $820,486 in 1909, as against $867,596 in 1908, a decrease of $47,110.

Camp Floyd district is credited with 99 per cent of the total gold produced in 1909 by the mines at Mercur and Sunshine. The silver yield of the county was 281,713 ounces in 1909, as against 378,373 ounces in 1908. Copper production decreased from 1,067,292 pounds in 1908 to 747,341 pounds in 1909. Lead decreased from 8,438,295 pounds in 1908 to 7,623,664 pounds in 1909. There was no production of zinc in 1908; but 1,817,542 pounds figured as spelter were produced in 1909. At milling plants using the cyanide process 285,960 tons of ore and 49,538 tons of tailings were treated, yielding $813,751 in gold and 181 ounces of silver, averaging a total recovery of $2.43 per ton. The concentration plants at Ophir and Stockton produced from the treatment of 38,984 tons of ore, 9,976 tons of concentrate, which yielded 117.26 ounces of gold, 121,858 ounces of silver, 483,743 pounds of copper, and 2,068,512 pounds of lead, with a total value of $217,623, and an average value of $21.81 per ton of concentrate. Crude shipping ore produced aggregated 19,243 tons and yielded 208.54 ounces of gold, 159,674 ounces of silver, 263,598 pounds of copper, 5,555,152 pounds of lead, and 1,817,542 pounds of zinc, with a total value of $458,627, and average value of $23.83 per ton.

Near Tooele the new copper smelter of the International Smelting and Refining Company was rapidly nearing completion and was expected to be ready for operation in July, 1910.

Camp Floyd district.—At Mercur the Mercur and Golden Gate mines and the tailing dump at the Sacramento mill were worked in 1909. At Manning lessees continued the re-treatment of tailings from the old mill dump of the Mercur mill, and at Sunshine the Sunshine mine was steadily operated during 1909, and the mill, which was remodeled with improved cyaniding apparatus, was successfully placed in operation during April. According to the annual statement issued by the Consolidated Mercur Company for its fiscal year ending June 30, 1910, the gold yield of 231,631 tons of ore milled was $613,148.92, or an average recovery of $2.65 per ton. The larger part of the ore treated in the cyanide mill, or 57 per cent of the total, was oxidized ore; the remainder was base ore and required roasting. Ninety-four cents in gold was lost in each ton of tailings. The cost for each ton of ore mined was $1.48 and the milling cost was $1.15. Nearly 65 per cent of the ore mined came from the Mercur mine, the remainder from the Golden Gate and the Brickyard mines. The company was operating its property on a close margin and found that the gold in its ores continued to decrease. Higher costs in crushing were caused by the Brickyard mine ore, which was very much harder than any ore heretofore encountered in its mines. This was one of the discouraging features of the year's operation and it was declared that there was nothing to encourage the belief that a better grade of ore would be encountered in any of its mines. It was generally understood that the company, although not making enough to pay dividends, was making expenses.

The Geyser-Marion cyanide mill at Mercur was totally destroyed by fire in 1909 just as arrangements had been made for its operation.

The Sacramento mill dump, which was estimated at 700,000 tons, was worked by lessees during a short period. From $2 tailings it was said that from $1.30 to $1.60 in gold per ton was extracted and that the costs of treatment were low.

At the Sunshine 150-ton mill the ore treated during the month of May averaged $3.48. The extraction of 88.7 per cent of the gold at a milling cost of 84.9 cents per ton was thought good, considering the talcose nature of the ore. The ore was separated into 50.85 per cent of sand and 49.15 per cent of slime. Sand tailings have averaged about 60 cents, slime tailings 20 cents, and the general tailings 39.3 cents per ton. Dividends paid in 1909 amounted to $13,500.

In the West Dip section of the district the Daisy mine and cyanide mill are being put in condition for operation.

Clifton district.—Gold Hill and Clifton are the two principal mining camps in the district; their post-office address is Callao, and Wendover, 40 miles to the north, on the Western Pacific Railway, is the shipping station. The present ore rate by wagon and rail is $20 per ton to Salt Lake City. A branch railroad may be built into the district from Wendover. A small quantity of gold bullion and rich gold ore produced from the Alvarado mine at Gold Hill represented the output of 1909. The gold is reported to occur free in a coarsely crystalized dolomite between limestone and granite. The last important gold milling operations on this property were with a Crawford ball mill, using the amalgamation process. This was previous to 1895, when about $200,000 in gold was produced.

The Gold Hill property of the Western Utah Copper Company attracted attention in its development of a body of carbonate lead ore, which was first found on the 300-foot level and again on the 350-foot and 600-foot levels. It is said that 125,000 tons of copper ore, containing 5 per cent of copper, had been developed previous to finding the lead-silver ore and that the ore bodies are independent of each other. The ore is reported in porphyry along a limestone contact, and to have been found as wide as 90 feet in both veins.

Columbia district.—Production in 1909 was from the Sharp mine. The concentration mill was operated a short time and a lead concentrate with lead ore of shipping grade was produced.

North Tintic district.—Eureka is the post-office, about 9 miles southeast, and Del Monte is the shipping station, on the San Pedro Railroad, about 4 miles east of the Scranton mine. It is said that the zinc and lead ore bodies have been followed on their strike north and south for about 4,000 feet. Mineralization is greater to the south, and developments here furnished large shipments of lead ore, below which was mined a shipping grade of zinc silicate ore, which found a ready market at the eastern zinc refineries. For several years only the highest grade zinc and lead ores were mined, but recently a market has been found for the lower grade ore, which crops to the surface on the hill to the north of the present workings. Some of this ore, containing both lead and zinc, was to be shipped to Wisconsin and used in the manufacture of pigment. The higher grade lead ore was shipped to the Salt Lake smelters.

Ophir district.—Most of the mining claims of the district were located in the early seventies, at which time high-grade silver ores, principally chlorides, were found outcropping on the surface. Large portions of the old workings are still accessible in several mines, and the old stopes indicate that a large tonnage of ore has been extracted. This applies largely to the Chloride Point and Northern Light mines, which have been consolidated with the Circle, Columbia, and Buffalo properties forming the Lion Hill Consolidated. To the north and across the canyon from the Lion Hill is the Ophir Hill mine. This mine has been worked successfully for twelve years and 5 distinct veins are said to have been developed to a depth of 1,700 feet on a dip of 35 degrees. During 1909 the mill and mine were operated, and part of the concentrate was shipped. The remainder awaits a better market. North of the Ophir Hill mine is the Cliff mine, which proved a steady producer of lead-silver ores of shipping grade in 1909. Other producers were the Hidden Treasure and Mono mines.

Rush Valley district.—The Honerine mine and mill, Honerine Extension, Old Bullion, and Honerine Western mine groups were consolidated at the close of the year, to be known in the future as the Bullion Coalition mines. The properties thus merged into one large estate of about 1,500 acres are all contiguous and are all on the Honerine vein, which has been productive for many years. During the last few years the upper stopes of the Honerine mine were worked by lessees.

Silver Islet district.—Several carloads of silver-lead-copper ore were first shipped from this district in 1908 from one of the claims of the Silver Island Coalition Company. During 1909 shipments were continued, but the tonnage of ore shipped was not important on account of the long wagon haul. The mine is situated north of Wendover, a station on the Western Pacific Railroad, near the Nevada-Utah line. The ore deposits are reported as occurring in bedded limestone at intersection of fissures.

UINTA COUNTY.

The 3,000-yard placer dredge of the Uintah Placer Company was put in operation for a short time in 1909, but reasons for its noncontinuance were not reported. It was sold at sheriff's sale the latter part of 1909. In October, 1908, this dredge was started and stopped during the same month, as it was found necessary to change its mechanism. At the Mitchell placers successful work was reported with a new sluicing device. The Uteland mine, situated near the old Ouray Indian trading station, was equipped with a 50-ton leaching plant for the treatment of copper ores found in the sandstone.

UTAH COUNTY.

Utah County has within its borders American Fork, Santaquin, and part of North Tintic and Tintic mining districts. The production in 1909 aggregated 78,822 tons of ore, all of which was of shipping grade, with the exception of 3,526 tons of ore treated at a concentration mill. The metallic content of the total ore was 13,366.69 ounces of gold, 2,995,658 ounces of silver, 27,957 pounds of copper, and 36,444,348 pounds of lead, with a total value of $3,404,797, and an average value per ton of $43.20. There was a decrease in copper, but in all other metals substantial increases were made over the output of 1908.

American Fork district.—In 1909 from 7 mines 1,025 tons of ore were shipped, yielding 125.15 ounces of gold, 39,821 ounces of silver, 10,670 pounds of copper, and 628,148 pounds of lead, having an aggregate value of $51,692, and an average value of $50.43 per ton. The production decreased from 4,706 tons, valued at $334,259, in 1907, to 2,356 tons, valued at $111,455 in 1908.

At the Dutchman mine, which is opened by a 1,200-foot adit, lessees succeeded in shipping an important tonnage of carbonate lead ore. The Miller Hill mine, also worked by lessees, produced lead ore of shipping grade.

Other producers were the Live Yankee, Milkmaid, Pacific, Pittsburg, and Sunday properties.

Santaquin district.—In the adit of the Union Chief mine at 1,450 feet from its portal the fissure in which high-grade silver-lead ore was found in the upper workings, has been cut. A wagon road around Dry Mountain was needed before shipments of ore from the upper deposit could be made. The property is about 3 miles east of Santaquin station on the San Pedro railroad.

Tintic district.—The output of 1909 greatly increased over that of 1908. It is mentioned under Juab County, and its production is given separately for the two counties.

WASHINGTON COUNTY.

No important new developments were recorded for Washington County in 1909. It was reported that the Reef mine was to be opened again for production, since development has disclosed a large tonnage of ore, which will average 4 per cent of copper, and which is amenable to leaching. A 125-ton mill is said to have been arranged for. The Free Coinage property produced some silver bullion, recovered in a 5-stamp amalgamation mill.

In the Tutsagubet district trial shipments of copper ore were made from the Jessie and the Surprise claims.

WASHINGTON.

By Charles G. Yale.

PRODUCTION.

The total value of the production of gold, silver, copper, and lead in the State of Washington in 1909 was $448,966, which was $70,150 more than in 1908. In 1909 the gold yield was 17,514.22 fine ounces, valued at $362,051; the silver yield was 74,488 fine ounces, valued at $41,334; and there were produced 255,134 pounds of copper, valued at $33,167, and 288,700 pounds of lead, valued at $12,414. This all came from 46 mines, of which 11 were placers of different kinds and 35 were deep mines, of which 25 were gold, 3 silver, 4 copper, and 3 lead.

The total tonnage of the State for the year was 36,308 short tons, as against 37,633 in 1908, a reduction of 1,325 tons. Stevens County had the largest tonnage, but the quantity showed a material decrease in 1909 from that in 1908. Siliceous ore increased 3,439 tons, the output being 33,035 tons in 1909, as against 29,596 tons in 1908. Copper ores decreased from 6,478 tons in 1908 to 2,382 tons in 1909, a reduction of 4,096 tons. Of lead ores there were 891 tons produced in 1909 as compared with 1,559 tons in 1908, a reduction of 668 tons. The average recovered value per ton in gold and silver in 1909 from siliceous ores was $11.75, as against $8.57 per ton in 1908. The average value per ton in gold and silver of the copper ore was $3.11, and of the lead ore $1.89. The average recovered value per ton of gold and silver of all ore—siliceous, copper, and lead—was $10.94 in 1909, as compared with $7.16 in 1908, an increase per ton of $3.78. The average value per ton of all metals in the siliceous ores was $12.01, as compared with $8.90 in 1908; of copper ores, $13.50, as compared with $6.68 in 1908; and of lead ores, $15.82, as compared with $34.19, or a total general average of $12.20 per ton, as compared with $9.54 in 1908, an increase of $2.66 per ton.

The total quantity of siliceous ores treated in the State at mills and smelters in 1909 was 33,035 tons, yielding in gold $354,927, in silver $33,321, and in value of all metals $396,719. The copper ores amounted to 2,382 tons, yielding $7,418 in gold and silver, and in value of all metals $32,115. The lead ores were 891 tons, yielding in gold and silver $1,679, or in all metals $14,092. The total value in gold and silver of all the ores was $397,345, and the total value of all metals from deep mines and placers was $448,966.

The statement of production for 1908 and 1909, showing increase and decrease, valued at each year's commercial prices, is as follows:

Mine production of gold, silver, and associated metals in Washington, 1908 and 1909.

Metal.	1908.		1909.		Increase (+) or decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold ... fine ounces..	11,718.07	$242,234	17,514.22	$362,051	+5,796.15	+$119,817
Silver ... do....	88,823	47,076	79,488	41,334	− 9,335	− 5,742
Copper ... pounds..	312,030	41,188	255,134	33,167	− 56,896	− 8,021
Lead ... do....	1,150,429	48,318	288,700	12,414	−861,729	− 35,904
Total ...	...	378,816	...	448,966	...	+ 70,150
Ore treated ... short tons..	...	...	36,308	*a* 12.20	...	...

a Value per ton, placer product excluded.

GOLD.

The total gold production of Washington in 1909 was 17,514.22 fine ounces, valued at $362,051, as compared with 11,718.07 ounces, valued at $242,234 in 1908, an increase in quantity of 5,796.15 ounces and in value of $119,817. The most productive of the counties was Ferry, with a yield of $210,437, followed in order by Stevens with $121,498, King with $10,501, and Okanogan with $8,907. The placers of the State yielded 289.67 fine ounces, valued at $5,988.

From siliceous ores were obtained 17,169.64 fine ounces, valued at $354,928; from copper ores 54.91 fine ounces, valued at $1,135; and from lead ores, none. This made a total from deep mines of 17,224.55 fine ounces, valued at $356,063, and a grand total from placer and deep mines of 17,514.22 fine ounces, valued at $362,051. The increase in entire production was 5,796.15 fine ounces, valued at $119,817.

The gold production from placers and different kinds of ores, by counties, with the increase or decrease, is shown in the following table:

Source of gold production in Washington, by kinds of ore, in 1909, by counties, in fine ounces.

County.	Placers.	Deep mines.				Grand total.
		Dry or siliceous ores.	Copper ores.	Lead ores.	Total.	
Chelan		204.72			204.72	204.72
Clallam		1.88			1.88	1.88
Ferry	9.00	10,170.89			10,170.89	10,179.89
King		507.99			507.99	507.99
Kittitas	265.48	16.50			16.50	281.98
Okanogan	1.21	397.11	32.56		429.67	430.88
Snohomish			2.37		2.37	2.37
Stevens	13.98	5,843.51	19.98		5,863.49	5,877.47
Whatcom		27.04			27.04	27.04
Total	289.67	17,169.64	54.91		17,224.55	17,514.22
Increase (+) or decrease (−)	−652.57	+6,432.31	+18.78	−2.37	+6,448.73	+5,796.15

SILVER.

The silver production of Washington in 1909 was 79,488 fine ounces, valued at $41,334, as compared with 88,823 fine ounces, valued at $47,076, in 1908. From siliceous ores was derived 64,078 fine ounces, an increase of 4,284 ounces over the production for 1908; from copper ores, 12,081 ounces, a decrease of 7,130 ounces; and from lead ores, 3,229 ounces, a decrease of 6,197 ounces. The total decrease from deep mines was 9,043 ounces. The placer yield in 1909 was 100 ounces only. Altogether the total decrease of silver output in 1909 was 9,335 ounces. The largest output of silver was obtained from Ferry County, which produced 53,694 ounces; the next county in importance was Stevens, with 21,571 ounces, and Okanogan County was third, with 3,248 ounces. Of the silver output, 12,081 ounces came from copper ores in Stevens, Snohomish, and Okanogan counties; and 3,229 from lead ores in Stevens County. The following table shows the source of silver production, by counties and by classes of ore, in 1909, with increase or decrease in each case:

Source of silver production in Washington, by kinds of ore, in 1909, by counties, in fine ounces.

County.	Placers.	Deep mines.				Grand total.
		Dry or siliceous ores.	Copper ores.	Lead ores.	Total.	
Chelan		117			117	117
Ferry	17	53,677			53,677	53,694
King		740			740	740
Kittitas	81	8			8	89
Okanogan		3,190	58		3,248	3,248
Snohomish			23		23	23
Stevens	2	6,340	12,000	3,229	21,569	21,571
Whatcom		6			6	6
Total	100	64,078	12,081	3,229	79,388	79,488
Increase (+) or decrease (−)	−292	+4,284	−7,130	−6,197	−9,043	−9,335

COPPER AND LEAD.

There were 255,134 pounds of copper produced in Washington in 1909, valued at $33,167; in 1908 there were 312,030 pounds, valued at $41,188. The largest producer of copper in 1909 was Stevens County, with 220,146 pounds; the next in importance was Okanogan County, which yielded 29,405 pounds; and Ferry and Snohomish counties followed with merely nominal quantities.

The lead output for the year 1909 was 288,700 pounds, valued at $12,414, as compared with 1,150,429 pounds, valued at $48,318, in 1908. The reason for this material decrease was that the principal lead producer in the State in 1908 was idle in 1909. Virtually all of the lead output in 1909 came from Stevens County.

MINING INDUSTRY IN WASHINGTON IN 1909.

The following table shows the production of gold, silver, copper, and lead in Washington in 1909, by counties:

Mine production of gold, silver, copper, and lead in Washington in 1909, by counties.

	Tonnage.	Gold.		Silver.		Copper.		Lead.		Total value.
		Quantity.	Value.	Quantity	Value.	Quantity.	Value.	Quantity.	Value.	
	Short tons.	*Fine ounces.*		*Fine ounces.*		*Pounds.*		*Pounds.*		
Chelan	131	204.72	$4,232	117	$61					$4,293
Clallam	3	1.88	39							39
Ferry	11,453	10,179.89	210,437	53,694	27,921	606	$79			238,439
King	272	507.99	10,501	740	385					10,887
Kittitas	121	281.98	5,829	89	46					5,876
Okanogan	1,221	430.88	8,907	3,248	1,689	29,405	3,822	23	$1	14,415
Snohomish	23	2.37	49	23	12	4,977	647			708
Stevens	23,034	5,877.47	121,498	21,571	11,217	220,146	28,619	288,677	12,413	173,747
Whatcom	50	27.04	559	6	3					562
Total	36,308	17,514.22	362,051	79,488	41,334	255,134	33,167	288,700	12,414	448,966

The total tonnage, by kinds of ore treated, in each county of Washington in 1909 is given in the following table, together with the increase or decrease as compared with the tonnage of 1908 and the average value of ores:

Tonnage of ore sold or treated in Washington in 1909, by kinds of ore and by counties, in short tons.

County.	Dry or siliceous ores.	Copper ores.	Lead ores.	Total.	Increase (+) or decrease (−) as compared with 1908.
Chelan	131			131	− 19
Clallam	3			3	+ 3
Ferry	11,453			11,453	+10,731
King	272			272	− 288
Kittitas	121			121	+ 121
Okanogan	940	281		1,221	− 283
Snohomish		23		23	− 2,760
Stevens	20,065	2,078	891	23,034	− 8,829
Whatcom	50			50	− 1
Total	33,035	2,382	891	36,308	− 1,325
Increase (+) or decrease (−)	+3,439	−4,096	−668	−1,325	
Average recovered value per ton in gold and silver	$11.75	$3.11	$1.89	$10.94	+ $3.78
Average recovered value per ton of all metals	12.01	13.50	15.82	12.20	+ 2.66

The following table shows the number of mines in Washington, by counties, according to their chief product, in 1909:

Number of producing mines, classified by chief product, in Washington in 1909, by counties.

	Total mines.	Gold placer mines.				Deep mines.				
		Hydraulic.	Drift.	Sluice.	Total.	Gold.	Silver.	Copper.	Lead.	Total.
Chelan	5					5				5
Clallam	1					1				1
Ferry	9	1			1	7	1			8
King	1					1				1
Kittitas	10	2	6		8	2				2
Okanogan	8			1	1	4	2	1		7
Snohomish	1					1				1
Stevens	11			1	1	4		3	3	10
Whatcom	1					1				1
Total	47	3	6	2	11	26	3	4	3	36

REVIEW BY COUNTIES.

CHELAN AND CLALLAM COUNTIES.

In Chelan County there were but 5 deep mines productive in 1909, and no placers. The total output of the deep mines was 131 tons of ore, yielding $4,232 in gold and 117 fine ounces of silver, with a total value of $4,293. Two of these mines are in Chelan district, at Chelan and Farris, whence the largest production of the county was derived; 2 at Blewett, in Peshastin district; and 1 at Entiat. In Clallam County a nominal production came from 1 mine.

FERRY COUNTY.

In Ferry County operators of 8 deep mines and 1 placer reported output for the year. Of the 8 deep mines, 7 are gold producers, and 1, the Dan Patch, is a silver property. The total output for the county was valued at $210,437 in gold, 53,677 fine ounces of silver, and 606 pounds of copper, with a total value of $238,437. In 1908 the value of the county yield was $21,674, of which $17,333 was in gold. The gold yield therefore increased $193,104 in 1909. Since 1907 the copper yield of the county has been nominal in quantity and value. The large increase in gold and silver in this county for 1909 was the most marked feature in the mining industry of the State for the period, and was due entirely to the developments in Republic district. In this district in 1909 there were 11,299 tons of ore treated, all at smelters, the yield from which was $209,114 in gold and $27,817 in silver. This was 58 per cent of the gold output of the State and 67 per cent of the silver output. The average value of the ore worked in the district was $20.92 per ton. The producing mines reported from this district were those of the Pearl Consolidated Mining Company, Insurgent Gold Mining Company, Midget Hold Mining and Milling Company, Imperator-Quilp Mining Company, and New Republic Mining Company, which are gold-quartz mines. To the west are the mines of the Belcher Mining Company, whose ores are sulphides. The ores from these mines were shipped to the following smelters: Granby, at Grand Forks, B. C.; British Columbia Copper Company, Greenwood, B. C.; Columbia, at Boundary, B. C.; Consolidated, at Trail, B. C.; and Tacoma, at Tacoma, Wash. At Covada, in this county, was 1 silver mine, with a nominal output, and at Danville 1 mine producing gold, silver, and copper. The other producers of the county are at Republic.

KING AND KITTITAS COUNTIES.

In King County, only 1 mine, a deep one, produced in 1909. Kittitas County has 10 productive mines, of which 2 are deep, and 8 placers. Of the placers, 2 are hydraulic and 6 drift. The output of the county was $5,829 in gold and $46 in silver, a total of $5,875. From the deep mines, 121 tons of ore were worked, yielding $341 in gold and $4 in silver. The placer yield was $5,488 in gold and $42 in silver, a total of $5,530. These placers are all at Liberty, and are either drift or hydraulic properties.

OKANOGAN COUNTY.

In Okanogan County in 1909 there were 8 producing mines, of which 1 was a placer and 7 were deep. Among the latter were 4 gold mines, 2 of silver, and 1 lead. The yield of the county was $8,907 in gold, 3,248 fine ounces of silver, 29,405 pounds of copper, and 23 pounds of lead, with a total value of $14,419. This was $14,631 less than the value of the yield of the county in 1908. There was a slight increase in the gold yield in 1909, but a material falling off in value of both silver and copper. From the 7 deep mines of the county were derived 1,221 tons of ore in 1909, of which 940 tons were siliceous and 281 copper ores. These ores yielded $8,882 in gold and the quantities of silver, copper, and lead given above. The deep mines which were productive are at Bodie, Chesaw, Methow, Nespelem, Nighthawk, and Oroville. No single one of the mines in the county produced a total of over $4,000.

STEVENS COUNTY.

Stevens County, which was the most productive county of the State in 1908, dropped to second place in 1909, being exceeded in total value of output by Ferry County. In 1909 the total value of the yield of the county was $173,747, as compared with $293,104 in 1908, a decrease of $119,357. In detail, the output of the county for the year was $121,498 in gold; 21,569 fine ounces of silver, valued at $11,217; 220,146 pounds of copper, valued at $28,619; and 288,677 pounds of lead, valued at $12,413. The decrease in gold value for 1909, as compared with 1908, was $62,395; in silver it was $17,030; in copper, 28,286 pounds in quantity and $4,174 in value; in lead, 858,252 pounds in quantity and $35,758 in value. There were 11 producing mines in the county in 1909, of which 10 were deep mines and 1 a placer. Of the deep mines, 4 are gold, 3 copper, and 3 lead. Of siliceous ores there were 20,065 tons, of copper ores 2,078 tons, and of lead ores 891 tons. The decrease of tonnage for the year was 8,829 tons. The most productive gold mine is at Orient; the most productive silver mine at Chewelah; the largest quantity of copper came from Chewelah; and of lead from Bossburg. Copper was produced from mines near Chewelah, and lead from mines near Bossburg, Colville, and Northport. The most productive district in the county in 1909 was Orient, and the mine yielding the largest values was the First Thought, in that district, with an output mainly gold. The ores from this property were shipped for treatment to the Northport smelter, the Trail Smelting Company, at Trail, B. C., and the British Columbia Copper Company, at Greenwood, B. C.

WHATCOM AND WHITMAN COUNTIES.

Whatcom County reported production from 1 small quartz mine in 1909, and there were no returns received from Whitman County.

WYOMING.

By Charles W. Henderson.

PRODUCTION.

The total value of the production of gold, silver, and copper in the State of Wyoming in the calendar year 1909 was $69,028, a decrease of $264,720, as compared with that of 1908. In 1909, the gold yield was 197.66 fine ounces, valued at $4,086; the silver yield was 1,754 fine ounces, valued at $912; and the copper output was 492,539 pounds, valued at $64,030. The copper output was 1,959,510 pounds less than in 1908. There were 11 producing mines, of which 8 were deep and 3 placer mines.

The tonnage sold or treated in 1909 was 2,393 short tons, as compared with 19,031 tons in 1908. In 1909 siliceous ore mined and treated amounted to 273 tons, the remainder of the tonnage, 2,120 tons, being copper ore. Deep mines yielded $2,972 in gold, 1,742 fine ounces in silver, and 492,539 pounds of copper, or an average value per ton of $1.24 in gold, 0.73 fine ounce in silver, and 10.29 per cent of copper.

The copper yield, valued at $64,030, represented 93 per cent of the value of the State total.

Mine production of gold, silver, and copper in Wyoming in 1908 and 1909.

Metal.	1908.		1909.		Decrease.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold....................fine ounces..	385.02	$7,959	197.66	$4,086	187.36	$3,873
Silver............................do....	3,998	2,119	1,754	912	2,244	1,207
Copper......................pounds..	2,452,049	323,670	492,539	64,030	1,959,510	259,640
Total.	....	333,748	....	69,028	....	264,720

The decrease in the output of the three metals from Wyoming mines was due principally to the idleness of the mines and smelter of the former Penn-Wyoming Company, at Encampment, Carbon County. There were no shipments from the Copper Mountain district, which yielded ore carrying gold, silver, and copper in 1908. Albany County became the chief mineral producing county in 1909, from the operations of the Rambler Copper and Platinum Company, at Holmes. There were shipments of copper ore from Elk Mountain, near Saratoga, Carbon County, and from Hartville, Laramie County. The mines at Atlantic City (or South Pass), Fremont County, produced a small quantity of gold and silver bullion, and a shipment of copper ore was made from the Willow Creek district, Fremont County. Albany County was also credited with an increased placer yield at Holmes. The placer output of Crook and Uinta counties, combined, also increased, from Beulah and Jackson Hole, respectively.

Source of gold and silver production in Wyoming in 1908 and 1909.

	Number of mines.	Tonnage.	Gold.		Silver.		Total value.
			Quantity.	Value.	Quantity.	Value.	
Deep mines:		*Short tons.*	*Fine ounces.*		*Fine ounces.*		
Siliceous ore..........	4	273	99.36	$2,054	13	$7	$2,061
Copper ore...........	4	2,120	44.41	918	1,729	899	1,817
Total, 1909, deep mines.............	8	2,393	143.77	2,972	1,742	906	3,878
Deep mines, 1908.........	6	19,031	345.35	7,139	3,990	2,115	9,254
Increase (+) or decrease (−)........	+2	−16,638	−201.58	−4,167	−2,248	−1,209	−5,376
Placer mines, 1909........	3	....	53.89	1,114	12	6	1,120
Placer mines, 1908........	5	....	39.67	820	8	4	824
Increase (+) or decrease (−)........	−2	....	+14.22	+294	+4	+2	+296
Total, 1909, deep and placer mines..	11	2,393	197.66	4,086	1,754	912	4.998

Mine production of gold, silver, and copper in Wyoming in 1908 and 1909.

County.	Producing mines.	Tonnage.	Gold.		Silver.		Copper.		Total.
			Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
		Short tons.	*Fine ounces.*		*Fine ounces.*		*Pounds*		
Albany, Carbon, and Laramie...	4	2,097	76.19	$1,575	1,704	$886	490,001	$63,700	$66.161
Crook and Uinta.	2	....	19.79	409	4	2	....	....	411
Fremont........	5	296	101.68	2,102	46	24	2,538	330	2,456
Total......	11	2,393	197.66	4,086	1,754	912	492,539	64,030	69,028

REVIEW BY COUNTIES.

ALBANY, CARBON, AND LARAMIE COUNTIES.

These three southern counties in Wyoming produced 96 per cent of the total value of the state yield.

ALBANY COUNTY.

The Rambler Copper and Platinum Company, operating the Rambler mine, at Holmes, was the principal operator in Albany County, and in Wyoming, in 1909. This company shipped 40 cars of high-grade copper ore, carrying gold and silver, during the year. The ore is reported to carry also platinum, palladium, iridium, osmium, and nickel. A 50-ton concentrating plant was built in the spring of 1910 to treat the lower grade ore. The shaft on this property was 170 feet in depth, and 2,000 feet of development work was done in 1909.

The American Gold Placer Company, also near Holmes, on Douglas Creek, during two months of the year, sluiced out considerable placer gold, running 0.875 fine.

Development work only was reported by operators of mines near Centennial.

CARBON COUNTY.

The Elkhorn Copper Mining Company, in the Elk Mountain district, near Saratoga, shipped copper ore to Argo, Colo. The workings on this mine consist of a vertical shaft 133 feet deep and a tunnel 475 feet long.

The Penn-Wyoming Copper Company's mines, smelter, and railroad, at Encampment, were taken over by the United Smelters Railway and Copper Company. Some development work was done in 1909.

A number of companies near Saratoga and Encampment and near Slater, Colo., reported considerable development work in 1909.

LARAMIE COUNTY.

A small shipment of copper ore was made from Hartville in the Platte Canyon district. Development work was done on several prospects in the same district and at Rawhide Buttes.

BIGHORN COUNTY.

There was no production in this county in 1909. Some development work was done by the companies in the Wood River district, near Kirwin.

CROOK COUNTY.

The yield from Crook County came from the placer mines in Hurricane district, northwest of Trinton, S. Dak. The yield in 1909 was very small.

FREMONT COUNTY.

In 1909 Fremont County ore sold or treated, from 5 mines, was 296 short tons, which carried values of $2,102 in gold and $24 in silver, and also 2,538 pounds of copper valued at $330—a total value of $2,456, as compared with $5,583 in 1908. Of this tonnage, the bulk came from the Atlantic City, or South Pass, district, in the south-central part of the county. A shipment of copper ore was made from the Willow Creek district, from near Shoshoni.

Atlantic and South Pass district.—The Dexter mill at Atlantic City was leased in the early part of the year by the McCandless Development Company. The mill is a 20-stamp amalgamation and cyanide plant. A small output in bullion was made. Other production, in the form of retorted bullion, was made by the operators of the Lucky Boy, the Mackey, and the Mormon Crevice mines. The X. L. Dredging Company, near Atlantic City, has been testing its 1,440 acres of placer property since 1908, and were building ditches and reservoirs in 1909–10. The Federal Gold Mining Company was engaged in development work at the Carissa mine, but no ore was treated in the company's 10-stamp amalgamation and concentration mill. The mine has been opened to a depth of 500 feet and has several thousand feet of drifts and crosscuts.

Copper Mountain and Willow Creek districts.—These districts lie near and between the towns of De Pass and Shoshoni. Only one shipment was made from this part of the county in 1909—a car of copper ore from the Shroeter prospect. Development work was done on several properties near Shoshoni.

There are several placer properties between Shoshoni and Riverton, one of which had ordered material for a dredge to be delivered in 1910.

JOHNSON COUNTY.

There was no production in this county in 1909. The operator on the La Porte mine, in the Bull Camp district, made several test runs in the 5-stamp mill on the property. Reports of development work performed were received from properties in the Bull Camp district, out from Buffalo.

SHERIDAN COUNTY.

Development work is reported from several properties.

UINTA COUNTY.

Placer gold was recovered by the Jackson Hole Mining Company from the Buffalo placer, in the Jackson Hole district.

SILVER, COPPER, LEAD, AND ZINC IN THE CENTRAL STATES IN 1909.

(MINE PRODUCTION.)

By B. S. BUTLER and C. E. SIEBENTHAL.

INTRODUCTION.

By C. E. SIEBENTHAL.

The following is an account of the production of silver, copper, lead, and zinc in 1909 by the mines of the Central States, including Arkansas, Iowa, Kansas, Kentucky, Michigan, Missouri, Oklahoma, and Wisconsin. The territory thus embraced lies in the great interior valley province of the United States, which extends from the Appalachian system to the Rocky Mountain front, excluding the Black Hills. Most of the mines are developed in the Paleozoic sedimentary rocks of this province, but the copper range of northern Michigan comprises lavas and intercalated sediments of pre-Cambrian age.

The statistics of production in this country have been compiled by the United States Geological Survey from confidential reports by each mine in operation and represent the quantity of metals recovered or paid for in the ore that was treated or sold during the year. These reports were procured by the Bureau of the Census and the United States Geological Survey, acting in cooperation. As the statistics of metal production collected by the Bureau of the Census were obtained in connection with the general census of the industries of the United States, by visits of field agents, the time required for the work was much greater than has been necessary in previous years. This accounts for the late appearance of this report.

On account of the size and complexity of the combined schedule used by the United States Geological Survey and the Bureau of the Census, some questions were omitted in 1909 which had previously been included in the Geological Survey schedules. Among these was the item calling for a description of new development during the year. For this reason the reviews of the Central States by districts which have heretofore been given are unavoidably omitted except for Michigan, most of whose copper mining companies publish annual reports describing their operation.

Statistics of mine production were first collected for Michigan for 1906. The mine census of all of the Central States was first undertaken for the year 1907. Its continuation for the year 1909 makes possible the direct comparison of the production for three successive years which has been made in the following pages. A comparison of the total production of lead and zinc by States as reported by the mines and by the smelters will be found in the chapters on those metals in the complete volume.

The method of marketing and recording the mine output in the lead and zinc regions of the Central States differs from that employed in the Western States. In the Western States the miner usually sells his ore according to the assay content of metal at a certain price per unit. In the lead and zinc regions of the Central States, however, where the material sold is principally concentrates,[a] payment is made according to a basis price for a certain quality of concentrate. The details of this method are given in the pages devoted to Missouri. The figures reported to the Survey by producers represent the tonnage and assay content of concentrates sold and the amount received in payment. The total metal produced is calculated from the first two of these items.

The mines in Michigan report the quantity of concentrates produced and the actual recovery of copper from concentrates smelted. In any year the mines may produce more or less concentrates than are smelted during the same period. The copper content of concentrates produced during the year, but not smelted, has been estimated on the basis of the average copper recovery per ton for the year of the company producing it.

TENOR OF LEAD AND ZINC ORES OF THE CENTRAL STATES.

Much of the ore mined in the Western States is crude smelting ore—that is, it can be smelted directly without preliminary concentration. All but a very small portion of the ore from the Central States is of such tenor that it requires concentration. The only fair basis for comparison of the relative magnitude of mining operations in different States is that of tonnage of crude ore, or "dirt," as it is usually called in the Central States lead and zinc regions. However, in those States it is only the larger companies which make any record of the crude ore raised. In the Joplin region the number of cans of ore hoisted is usually recorded and the approximate weight of the cans is generally known. Thus each company knows, in a general way, about what percentage of concentrates the mine run is yielding. Knowing the total production of concentrates and the average yield of concentrates from crude ores, one can arrive at a close estimate of the crude ore raised. The quantity of crude lead and zinc ores raised has been requested annually on the United States Geological Survey schedules since the mine census was undertaken in the Central States in 1907, and for many of the mines it has been reported. Only the actual operating companies have the data, however, and it is the practice of the Geological Survey, in order to shorten the list of producers as much as possible, to send requests to only the owners of the mining land, or the companies holding first leases, and to depend upon them to report the whole production of the tract. In this way the crude ore reported has represented such a small fraction of the total that it has not been considered advisable to publish it. For 1909, however, the general census necessitated a report from every operator and the data in regard to crude ore are so much more complete that the average percentage of concentrates in the crude ore has been calculated from those schedules in which the crude ore is given. This has been done for each State, and in Missouri separate calculations have been made for the "soft ground" and the "sheet ground" of southwest Missouri and for the disseminated lead ore of southeast Missouri. These average percentages have been applied to the total concentrates produced, thus working back to the total quantity of crude ore raised. On comparison with similar average percentages gained from the more limited data received in the Mineral Resources canvass for 1908, there was found to be a very fair agreement. Therefore the calculations have been carried back to include the year 1908, and the tables of ore tenor which follow in the sections devoted to the respective States show the comparative percentages for the two years. In certain States, notably Iowa, Kentucky, and the southern part of Illinois, it was not possible or advisable to make such calculations. In Kentucky and southern Illinois, the lead and zinc ores are recovered as by-products in the concentration of the fluorspar which they accompany. In Iowa, in 1908 and 1909, the quantity of ore raised was so small and the number of producers so limited that the calculation of averages and of the crude-ore production would be misleading.

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[a] In local usage the ore as mined is called "dirt" and the concentrates are classed as "ore."

Tenor of copper, lead, and zinc ores of Central States.

States.	1908		1909	
	Crude ore.	Metal content.[a]	Crude ore.	Metal content.[a]
	Short tons.	*Per cent.*	*Short tons.*	*Per cent.*
Arkansas	16,550	4.4	12,800	4.7
Illinois (northern)	69,910	3.1	73,875	4.2
Kansas	677,722	2.8	595,786	2.4
Michigan	10,531,271	1.02	11,429,394	1.06
Missouri	8,755,353	3.1	11,480,654	2.6
Oklahoma	225,184	3.2	317,574	3.9
Wisconsin	475,689	5.4	696,389	4.3

[a] The percentages given in this column represent the metal content of the ore in so far as it is recovered in the concentrates. In Michigan the metal so recovered is copper; in the other Central States the metals are lead and zinc, the relative proportions of which are shown in the table on the next page, and in the tables of ore tenor given in the sections devoted to the respective States.

PRODUCTION.

SILVER.

The production of silver in the Central States in 1909 was 301,629 fine ounces, which, at the average price of 52 cents per fine ounce, had a value of $156,848, as compared with 292,237 fine ounces, valued at $154,885, in 1908. No silver ores are worked in the Central States, and the comparatively small quantity of silver that is produced is recovered incidentally to the production of other metals. The greater part of the output comes from the copper lodes of Michigan, but lead ores of southeast Missouri and the lead-zinc-fluorspar deposits of the Kentucky-Illinois field also carry silver, some of which is recovered from the lead concentrates.

COPPER.

Complete figures of the production of copper in the Central States in 1909 are not given, in order to avoid disclosing the output of individual producers. Michigan and Missouri are the only copper-producing States, the former contributing nearly the entire copper output of the Central States. The copper production of Michigan in 1909 was 234,136,529 pounds, which, at the average New York price of 13 cents per pound, was worth $30,437,749, as against a production of 223,286,700 pounds, valued at $29,473,844, in 1908.

LEAD.

The production of lead by the mines of the Central States in 1909 was 168,221 short tons, which, reckoned at the average New York price of the metal for the year, $86 per ton, or 4.3 cents per pound, amounted to $14,467,006, as compared with 153,361 short tons, valued at $12,882,324 in 1908. Missouri, as usual, leads the other Central States in the production of lead, and repeated the record made in 1907 and duplicated in 1908 by again taking first place in the United States. The disseminated lead district of southeast Missouri exceeded the production of the Cœur d'Alene district of Idaho and remains the largest single lead-producing district in the United States.

ZINC.

The production of zinc in the Central States in 1909, based on returns from the mines, with a deduction for smelting loss, was 175,337 short tons. The value of this output, computed at $108 per ton, or 5.4 cents per pound, the average St. Louis price of the metal for the year, was $18,936,396. The production of zinc in the Central States in 1908 was 146,975 short tons, valued at $13,815,650. Missouri again leads the Central States, and the United States as well, in the production of zinc.

SUMMARY OF PRODUCTION BY STATES.

The total value of the production of silver, copper, lead, and zinc in the Central States in 1909 was $63,997,999,[a] as compared with $56,326,703 [a] in 1908. The contributions of each State and each metal to this total are shown in the following table:

Production of silver, copper, lead, and zinc in the Central States in 1909, by States.

State.	Silver.		Copper.		Lead.		Zinc.		Total value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
	Fine ounces.		*Pounds.*		*Short tons.*		*Short tons.*		
Arkansas					24	$2,064	510	$55,080	$57,144
Illinois	1,011	$526			295	25,370	2,163	233,604	259,500
Iowa					36	3,096	35	3,780	6,876
Kansas					1,300	111,800	11,445	1,236,060	1,347,860
Kentucky					10	860	64	6,912	7,772
Michigan	286,430	148,944	234,136,529	$30,437,749					30,586,693
Missouri	14,188	7,378			159,435	13,711,410	130,162	14,057,496	27,776,284
Oklahoma					3,427	294,722	7,806	843,048	1,137,770
Wisconsin					3,694	317,684	23,152	2,500,416	2,818,100
Total	301,629	156,848	234,136,529	[a] 30,437,749	168,221	14,467,006	175,337	18,936,396	63,997,999
Total, 1908	292,237	154,885	223,286,700	[a] 29,473,844	153,361	12,882,324	146,975	13,815,650	56,326,703
Total, 1907	328,411	216,751	217,767,232	[a] 43,553,446	146,379	15,516,174	156,027	18,411,086	77,697,457

[a] Not including value of copper production of Missouri.

ARKANSAS.

By C. E. Siebenthal.

PRODUCTION.

The production of lead and zinc in Arkansas in 1909 is shown in the following table:

Production of lead and zinc in Arkansas in 1909, in short tons.[a]

District.	Ore.						Metal content.			
	Lead concentrates.		Zinc concentrates.				Lead.		Zinc.	
	Galena.		Sphalerite.		Silicate and carbonate.					
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
North Arkansas, 1909	30	$1,800	896	$33,948	98	$2,736	21	$2,064	510	$55,080
Same, 1908	18	985	516	18,270	939	21,469	15	1,260	605	56,870
Same, 1907	15	800	538	15,233	663	16,210	12	1,272	474	55.932

[a] In calculating the metal content of the ores from assays allowance has been made for smelting losses in case of zinc but not in the case of lead. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, while the value of the metal is calculated from the average daily quotations at New York and St. Louis.

Tenor of lead and zinc ore and concentrates produced in Arkansas, 1908–1909.

	1908	1909
Total crude ore ......short tons..	16,550	12,800
Total concentrates in crude ore ......per cent..	8.9	8.0
Lead ......do....	.1	.2
Zinc ......do....	8.8	7.8
Metal content of crude ore ......do....	4.4	4.7
Lead ......do....	0.1	.2
Zinc ......do....	4.3	4.5
Average lead content of lead concentrates ......do....	83.0	80.0
Average zinc content of sphalerite concentrates ......do....	60.1	60.3
Average zinc content of silicates and carbonates ......do....	42.8	39.8
Average value per ton of lead concentrates	$54.72	$60.00
Average value per ton of sphalerite concentrates	$35.41	$37.89
Average value per ton of silicates and carbonates	$22.86	$27.91

NORTHERN ARKANSAS.

Lead and zinc deposits have been known in Arkansas for many years. Lead was noted by Schoolcraft in his travels in 1819, and has been mined in a desultory way since the settlement of the State. Present development dates from about 1899, when there was a great rush to the northern Arkansas field. The mines are principally in Marion County and in the adjoining portions of Searcy, Newton, and Boone counties, though there are also numerous mines and prospects in Baxter, Izard, Sharp, Lawrence, and other counties to the east, and a deposit has recently been developed in Washington County on the extreme west border of the State.

The ores are galena, sphalerite, and smithsonite. The sphalerite is generally very high grade, the concentrates, when clean, ranging well above the price basis, 60 per cent metallic zinc content. The sphalerite and smithsonite are shown by analysis to contain appreciable quantities of cadmium, a yellow variety of smithsonite, known locally as "turkey fat," showing as high as eight-tenths of 1 per cent of cadmium. The ore bodies occur in fissures or crevices, in fault breccias, and in solution breccias. The ore deposits are for the most part found in the Yellville limestone of Ordovician age, but some also are found in the Boone formation of lower Carboniferous age.

Until recently the mines labored under the disadvantage of a long wagon haul to the railroad and of high freight rates. Other handicaps are the lack of keen competition among ore buyers and the added cost and the loss of time in obtaining supplies and repairs, though these conditions will doubtless improve with the development of the field. The completion of the White River branch of the St. Louis, Iron Mountain and Southern Railroad and of the St. Louis and North Arkansas Railroad has brought most of the producing mines within 10 miles of railway transportation and greatly improved the situation in this regard. Land for mining purposes is ordinarily leased in 10-acre tracts at 10 per cent royalty. Wood is universally used for fuel at the mines. Since 1907 the number of steam concentrating plants in the northern Arkansas region has always been above 20, but usually not more than a third of them has been in operation in any one year These are of the Joplin type, and average about 100 tons in daily capacity. Mining methods are similar to those in vogue in the Joplin region, except that, owing to the rugged character of the country, many deposits have been found outcropping on the hillside and have been followed in by tunnels. Shallow deposits are won by open pits. Hand drills are generally used, though a few of the larger plants have installed air or steam drills. Prospecting is done by means of the churn drill, and an encouraging feature of recent work has been the greater depth to which prospecting has been carried.

The assistance rendered by Prof. R. W. Willett in the preparation of this account of the lead and zinc production of Arkansas is gratefully acknowledged.

ILLINOIS.

By C. E. Siebenthal.

PRODUCTION.

The production of lead, zinc, and silver in Illinois in 1909 is shown in the following tables:

Production of lead and zinc in Illinois, in 1909, in short tons.[a]

	Ores.				Metal content.			
	Lead concentrates, galena.		Zinc concentrates, sphalerite.		Lead.		Zinc.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
State total, 1909	372	$19,122	5,206	$165,099	295	$25,370	2,163	$233,604
Same, 1908	575	24,678	[b] 4,468	101,850	399	33,516	1,717	161,398
Same, 1907	1,117	61,628	2,530	37,728	830	87,980	737	86,966

[a] Owing to the fact that in 1909 there was but one producer in the Southern Illinois district and one in the Elizabeth-Sand Prairie district, the production is not given by districts in order to avoid disclosing individual business. In calculating the metal content of the ores from assays allowance has been made for smelting losses in case of zinc but not in the case of lead. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, while the value of the metal is calculated from the average daily quotations at New York and St. Louis.

[b] Including 70 tons of zinc carbonate (drybone).

Production of silver in southern Illinois, 1907–9.

Year.	Silver.		Lead concentrates, silver-bearing.	
	Quantity.	Value.	Quantity.	Ounces of silver per ton.
	Fine ounces.		*Short tons.*	
1907	2,852	$1,882	497	5.738
1908	2,051	1,087	359	5.713
1909	1,011	526	259	3.903

Tenor of lead and zinc ore and concentrates produced in Illinois, 1908–9.

	1908.	1909.
Northern Illinois:		
Total crude ore ... short tons..	69,910	73,875
Total concentrates in crude ore ... per cent..	6.7	7.2
Lead ... do....	.3	.2
Zinc ... do....	6.4	7.0
Metal content of crude ore ... do....	3.1	3.4
Lead ... do....	.2	.1
Zinc ... do....	2.9	3.3
Average lead content of lead concentrates ... do....	80.6	77.9
Average zinc content of sphalerite concentrates ... do....	45.2	47.2
Average value per ton of lead concentrates	$52.05	$48.64
Average value per ton of sphalerite concentrates	$22.80	$31.71
Southern Illinois:		
Average lead content of lead concentrates	62.7	62.7
Average value per ton of lead concentrates	$37.42	$39.45

The lead concentrates produced in southern Illinois are recovered in concentrating the fluorspar. To speak of the total crude ore raised as crude lead ore would be misleading. No attempt has been made, therefore, at calculating the tenor of the crude ore.

The lead and zinc deposits of Illinois fall into two distinct regions marked by different mineralogical association and structural environment. Those of southern Illinois belong to the Kentucky-Illinois fluorspar district; those of northern Illinois belong to the upper Mississippi Valley region.

NORTHERN ILLINOIS.

The lead and zinc mines of northern Illinois are all in Jo Daviess County, the extreme northwest county of the State. The ores have the same structural relations as in the upper Mississippi district generally; that is, they occur disseminated through the limestone, or in openings in it called "crevices," "pitches," or "flats," depending on their attitude to the horizontal. These openings have in general an east and west trend, known as their range. The ore bodies are sometimes continuous for long distances along these ranges, which for that reason largely control the prospecting, both by shafts and by drilling. The ore deposits occur in the Galena dolomite and in the upper part of the Platteville limestone, both of Ordovician age. The ores are galena, sphalerite, and smithsonite, though the latter is much less common now than formerly, when the deposits worked were mostly shallow and above water level. The galena is practically nonargentiferous, and the zinc ores are not known to contain cadmium.

Iron pyrites are very commonly associated with the ores, frequently in such quantity as to necessitate roasting and magnetic separation. Some of the concentrating plants have calciners or roasters attached, and there is a custom roaster operated by the Joplin Separator Company at Galena, as well as custom roasters near by in Wisconsin and the electrostatic separator of the American Zinc Ore Separating Company at Platteville, Wis.

The production of zinc blende concentrates in 1909 showed an increase of one-sixth over that of the previous year, which was due chiefly to the enlarged production of the Vinegar Hill Mining Company.

SOUTHERN ILLINOIS.

The lead and zinc deposits of southern Illinois are found in Pope and Hardin counties in rocks of lower Carboniferous age, and are the northern extension of the Kentucky-Illinois fluorspar district. The structural relations and the mineralogical association are similar to the deposits of western Kentucky and in striking contrast to those of northern Illinois. The ores occur in fissure veins, in association with jointing and faulting. The mines have been worked to depths of 300 and 500 feet without disclosing any decrease in the dimensions of the ore bodies. Dikes and sheets of lamprophyre and dikes of mica peridotite occur in the vicinity, but not in direct connection with the ore deposits. Galena is the most important metallic mineral. Formerly, and nearer the surface, large bodies of galena were worked, but it is at present produced incidentally in the concentration of the fluorspar. For this reason it would be misleading to give crude ore tonnage.

The galena of southern Illinois is notably argentiferous as compared with the rest of the Mississippi Valley ores, the silver content ranging up to 12 and 14 fine ounces per ton of lead concentrates, and averaging for the last three years from 4 to 6 fine ounces per ton of lead concentrates. Sphalerite or zinc blende is the next important metallic mineral, but it occurs much less plentifully than galena. It is recovered as zinc middlings in the concentration of the fluorspar. The difficulty of making a clean separation of the zinc middlings has kept down the production of zinc. None has been sold from southern Illinois in the last three years. The principal vein minerals are fluorspar, calcite, and barite.

As the district is not reached by railway, the product of the mines is dependent on river transportation. There are 7 fluorspar concentrating mills in the district, ranging in capacity from 15 tons to 75 tons, all but 1 of which also recover more or less lead concentrates. They are generally equipped with jigs and concentrating tables. The proportion of lead concentrates to fluorspar concentrates varies with the different mines from 1½ per cent to 8 per cent. Reckoned by the quantity of fluorspar and lead concentrates produced, a 20-ton mill working on the vein fluorspar of this district is equivalent to a 100-ton or a 200-ton mill in the Joplin region.

IOWA.

By C. E. SIEBENTHAL.

PRODUCTION.

The production of lead and zinc in Iowa in 1909 is shown in the following table:

Production of lead and zinc in Iowa in 1909, in short tons.[a]

District.	Ore.						Metal content.			
	Lead concentrates.		Zinc concentrates.				Lead.		Zinc.	
	Galena.		Sphalerite.		Carbonate.					
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Dubuque, 1909	45	$2,079	......	....	100	$1,500	36	$3,096	35	$3,780
Same, 1908	63	3,613	829	$23,183	....	....	51	4,284	395	37,130
Same, 1907	304	22,023	303	8,577	....	......	242	25,652	145	17,110

[a] In calculating the metal content of the ore from assays, allowance has been made for smelting losses in the case of zinc but not in the case of lead. In comparing the value of ore and metal content it should be borne in mind that the value given for the ore is that actually received by the producer, while the value of the metal is calculated from the average daily quotations at New York and St. Louis.

Tenor of lead and zinc concentrates produced in Iowa, 1908–9.

	1908.	1909.
Average lead content of lead concentrates........per cent..	80.95	80.0
Average zinc content of lead sphalerite concentrates........do....	56.09	....
Average zinc content of carbonate concentrates........do....	....	40.0
Average value per ton of lead concentrates	$57.35	$46.20
Average value per ton of sphalerite concentrates	$27.97	....
Average value per ton of carbonate concentrates	....	$15.00

It is not deemed advisable to publish figures of the total crude ore production of Iowa in either 1908 or 1909. The production of sphalerite concentrates in 1908 was practically all from the Avenue Top mine. The output of other concentrates for each year was made up of small lots obtained as the result of development work and these are not a fair clue to the average ore tenor. As noted below, the ores occur under much the same condition as in Wisconsin, and the averages reached for that State would hold reasonably well for Iowa.

The lead and zinc deposits of Iowa extend along Mississippi River for nearly 80 miles in Dubuque, Clayton, and Allamakee counties. They are found in the Galena dolomite, of Ordovician age. In early days the Dubuque mines were the most important source of lead in the United States, and in later years the mines, especially those in the vicinity of Durango, yielded considerable quantities of zinc carbonate ore. Nearly all this earlier mining was done above water level, and only within the last few years has there been much attempt to mine below water level. Therefore, the production, particularly of zinc ore, for these years, though small, is noteworthy, since it marks the transition from shallow to deeper mining.

The ore deposits of the Dubuque district occur in crevices and in caves or "openings" along these crevices. Of these openings there are five or six, the "top," "middle," and "third" being the most prolific of ore. The "flats" and "pitches" common in the Wisconsin mines have been found in only one or two instances in Iowa. The crevices have an east-west trend, and sometimes extend considerable distances, being mined at different places, in which case they are known as "ranges." The mining operations of recent years have generally been confined to attempts to find paying ore at deeper levels in these old ranges which are known to have yielded ore in former days in the upper openings.

There are but two lead and zinc concentrating plants in the State, the Fitzpatrick Lead Mining Company's mill at Buena Vista and one connected with the Avenue Top mine at Dubuque, neither of which were in operation in 1909. The Avenue Top mine and mill were taken over by the Agaunico Mines Development Company late in the year and plans were laid for active work in 1910.

KANSAS.

By C. E. SIEBENTHAL.

PRODUCTION.

The production of lead and zinc in Kansas in 1909 is shown in the following table:

Production of lead and zinc in Kansas in 1909, by districts, in short tons.[a]

District.	Ores.								Metal content.			
	Lead concentrates.				Zinc concentrates.				Lead.		Zinc.	
	Galena.		Carbonate.		Sphalerite.		Carbonate and silicate.					
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Galena	1,466	$70,461	......	......	14,934	$555,169	503	$8,215	1,129	$97,094	7,348	$793,584
Badger-Peacock	211	11,119	......	......	7,814	326,119	......	......	169	14,534	4,049	437,292
Playter	3	148	......	......	92	2,995	......	......	2	172	48	5,184
State total, 1909	1,680	81,728	......	......	22,840	884,283	503	8,215	1,300	111,800	11,445	1,236,060
Same, 1908	3,205	170,227	......	......	28,524	932,646	395	4,414	2,518	211,512	14,119	1,327,186
Same, 1907	3,192	182,603	8	$303	35,871	1,444,723	94	489	2,555	270,830	17,772	2,097,096

[a] In calculating the metal content of the ores from assays, allowance has been made for smelting losses in case of zinc but not in the case of lead. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, while the value of the metal is calculated from the average daily quotations at New York and St. Louis.

Tenor of lead and zinc ore and concentrates produced in Kansas, 1908–9.

	1908.	1909.
Total crude ore .... short tons..	677,722	595,786
Total concentrates in crude ore .... per cent..	4.7	4.2
Lead .... do....	.5	.3
Zinc .... do....	4.2	3.9
Metal content of crude ore .... do....	2.8	2.4
Lead .... do....	.4	.2
Zinc .... do....	2.4	2.2
Average lead content of lead concentrates .... do....	78.6	77.4
Average zinc content of sphalerite concentrates .... do....	57.7	56.1
Average zinc content of silicates and carbonates .... do....	40.0	38.0
Average value per ton of lead concentrates	$53.11	$48.65
Average value per ton of sphalerite concentrates	$32.70	$38.72
Average value per ton of silicates and carbonates	$11.17	$16.33

The lead and zinc deposits of Kansas, so far as developed, are limited to the southeastern portion of the State, in Cherokee County. They comprise the western extension of the ore deposits of the Joplin region and display the general characteristics of that area, except that here typical sheet ground deposits have not been extensively developed. The ores are galena and lead carbonate, sphalerite or zinc blende, and zinc carbonate and silicate. The galena is practically nonargentiferous, carrying but a small fraction of an ounce of silver to the ton of lead concentrates. The lead and zinc ore production of Kansas showed in 1909 a falling off from the output of 1908, which was in turn a reduction from that of 1907, notwithstanding which the outlook for the future is bright, owing to the initiation of several enterprises, which, if carried to fruition, will vitally affect the future of the region. The Short Creek bottom, the old workings in which had been flooded since the washing away of the Short Creek flume several years ago, was drained early in the year, opening up the Hoy, Hoosier, Windsor, and several other tracts which were immediately occupied by a small army of operators. Among other new mills are the Nymo mill on the Maggie Taylor tract and the Diplomat on Owl Creek. The Clermont mill was completed and mining operations were begun at the 180-foot level. The ore is found in sheet formation in very dark chert, and the blende concentrates are of high grade for the Galena district, averaging about 60 per cent. The Clermont mine is in virgin territory, being the first mine south of Shoal Creek in this vicinity, and extends the district almost 2 miles further southward. The Playter interests purchased the Foster tract just west of Galena, acquired the Boughton lease south of Galena, leased the O'Neill land southwest of Galena, and entered upon an active campaign of prospecting. On the Murphy land in the western part of Empire, F. B. Wilcox sunk six drill holes, which indicated an ore body at from 240 to 280 feet in depth, and a shaft was begun. On the line of the Ping and Robertson lands the Ihlseng shaft was completed to a depth of 280 feet near the close of the year, and drifts started at the 250-foot and the 265-foot levels. The shaft is 6 by 15 feet in size. The mill, construction of which was begun, is planned to consist of two units each of 400 tons capacity.

KENTUCKY.

By C. E. Siebenthal.

PRODUCTION.

Lead and zinc deposits are found in central Kentucky and in western Kentucky. The majority of mines in both these districts were either idle during 1909 or engaged in development work. The lead and zinc ores in western Kentucky are chiefly recovered as by-products incidental to the concentration of fluorspar. To speak of the total crude ore raised as crude lead ore would be misleading. No attempt has been made therefore at calculating the tenor of the crude ore. The dullness of the fluorspar market in 1908 and 1909 is responsible for the small production of lead and zinc ore in these years. The production of lead and zinc in 1909 was 12 short tons of lead concentrates, valued at $620, and 150 tons of zinc carbonate concentrates, with a reported value of $1,701. No production was reported for 1908. The tariff act of 1909 imposed an import duty of $2.50 per ton upon fluorspar. It is expected that henceforth the fluorspar from this region can undersell the foreign fluorspar for fluxing purposes in Pittsburg and the Lake cities. A revival of the fluorspar industry will result in an increased lead and zinc production for this region.

CENTRAL KENTUCKY.

The ore deposits of this district are in Mercer, Scott, Franklin, Owen, Henry, and adjoining counties, in rocks of Lower Ordovician age. The ore, mostly lead, occurs in veins associated with such gangue minerals as barite, fluorite, and calcite. In some instances the lead has been obtained incidental to the mining of these minerals.

The Mutual Mining Company operated in Franklin County, the deposit consisting of a fissure vein 6 feet in width which has been followed to a depth of 180 feet. The ore is barite with a small proportion of lead. The concentrating and smelting plant is located near Stamping Ground. The mill has a daily capacity of 40 tons. The lead concentrate is a by-product, and attention is chiefly directed to the production of barium sulphate (blanc fixe) and sodium sulphide.

In Owen County the Ohio Lead Mining Company has at Gratz a good concentrating plant and has mined some lead ore. Lead only has been recovered, the barite tailings going to the waste pile. The vein, from 6 inches to 6 feet in width, has been followed vertically to a depth of 400 feet, and laterally for 1,000 feet, work being carried on at 3 levels. After much experimentation a chemical plant has been designed to treat the barium and to save the lead as a by-product.

WESTERN KENTUCKY.

The lead and zinc deposits of the western or fluorspar region of Kentucky are found chiefly in Caldwell, Crittenden, and Livingston counties, but continue northward across Ohio River, forming the southern Illinois lead and zinc region, and also southward in occasional deposits into western Tennessee. The ore deposits occur principally in rocks of the Chester and Meramec groups, of lower Carboniferous age. The ores are galena, sphalerite, and smithsonite, and occur in association with such gangue minerals as fluorspar, barite, and calcite. The sphalerite and the smithsonite are in many cases cadmium-bearing, and the lead is argentiferous. The silver content ranges from a very small quantity to over 3 ounces per ton. The lead product in 1909 was not smelted during that year—the silver recovery will therefore be reported in the production of 1910.

The ores occur in veins, in breccias, and as metasomatic replacements, all within or adjacent to zones of faulting. In several mines and prospects the ore occurs in contact with or adjacent to dikes of mica peridotite. Considerable quantities of both lead and zinc ores have been produced in the past, but at the present time they are produced as by-products in the recovery and concentration of fluorspar, which is the principal economic mineral. According to a recent report of the Kentucky Geological Survey there are in the district 10 plants for the concentration of fluorspar and for the separation and saving of lead and zinc concentrates. These are in the main similar to the smaller mills of the Joplin region, but adapted to local needs by the addition of grinding machinery and concentration tables.

MICHIGAN.

By B. S. Butler.

PRODUCTION.

In 1909 the mines of Michigan produced 234,136,529 pounds of copper, valued at $30,437,749, and 286,430 fine ounces of silver, valued at $148,944, a total value in copper and silver of $30,586,693. This is an increase of $985,090 in value, or about 3 per cent, over the production of 1908. In 1908 the average price of copper was $0.132 and in 1909 it was $0.13; the average price of silver in 1908 was $0.53 per fine ounce and in 1909 it was $0.52. Owing to the decrease in copper content of the rock treated and to the slight falling off in price of copper, the average value per ton of rock decreased from $2.81 in 1908 to $2.68 in 1909. The following table shows the average values in copper and silver of rock treated in 1908 and 1909:

Value of silver and copper product of Michigan mines in 1908 and 1909.

	Silver.	Copper.		Combined silver and copper.
	Value.	Value.	Value per ton of rock.	Total value.
1908	$127,759	$29,473,844	$2.79	$29,601,603
1909	148,944	30,437,749	2.66	30,586,693
Increase (+) or decrease (−)	+21,185	+963,905	−0.13	+985,090

The entire Michigan output of copper and silver is from the Keweenaw district. Both metals occur native in lodes remarkable for their great extent and uniformity. These lodes may be divided into two general classes—the amygdaloid, in which the metals occur in the cellular portions of lava flows, and the conglomerate, in which the metals cement and to some extent replace the pebbles forming the conglomerate. Native copper and copper minerals occur in fissures in the district, but at the present time the output from deposits of this type is of little importance. The rock [a] is of low grade and requires milling, which produces "mineral" carrying an average of 65 per cent copper. A small amount of "barrel" and "mass" copper is sorted at the mines and sent direct to the smelters.

In 1909 there were 11,429,394 tons of rock milled, which yielded 358,862,935 pounds of "mineral" and 234,136,529 pounds of copper.[b] The recovery of refined copper per ton of rock milled in 1909 was 20.5 pounds; in 1908 it was 21.2 pounds.

There were 1,364 ounces of silver recovered as "pickings" and the remainder, 285,066 ounces, was derived from the electrolytic treatment of 31,500,113 pounds of copper. This electrolytic copper was recovered from approximately 1,500,000 tons of rock, an average of about 0.19 fine ounce of silver per ton of rock. The 1,364 ounces of silver "pickings" were recovered from mines producing about 149,000 tons of rock, an average of 0.009 fine ounce of "pickings" per ton of rock. The "pickings" represent but a small percentage of the silver content of the rock, the remainder going into the copper.

The following table shows the production of metal, "mineral," and rock in Michigan in 1908 and 1908:

Production of silver, copper, "mineral," and 'rock" in Michigan in 1908 and 1909.

	Silver.	Copper.			"Mineral."		"Rock."
	Quantity.	Quantity.	Yield per ton of "rock."		Quantity.	Yield.	
	Fine ounces.	*Pounds.*	*Pounds.*	*Per cent.*	*Pounds.*	*Per cent.*	*Tons.*
1908	241,055	223,286,700	21.2	1.06	339,233,252	65.82	10,531,271
1909	286,430	234,136,529	20.5	1.025	358,862,935	65.24	11,429,394
Increase (+) or decrease (−)	+45,375	+10,849,829	−.7	−.035	+19,629,683	−.58	+898,123

The following table shows the relative importance of the amygdaloid and the conglomerate rock in 1908 and 1909. The most significant facts brought out are the continued decrease in the copper derived from the conglomerate and in copper content of the conglomerate. The copper derived from conglomerate dropped from 39.3 per cent in 1908 to 34.7 per cent in 1909, and the yield per ton of rock from 30.9 in 1908 to 28.7 in 1909. No accurate record of the silver recovered from conglomerate as distinguished from amygdaloid rock is available for 1909.

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[a] Some of the terms used to designate the different materials entering into the mining industry differ for the Lake district from those employed in any other part of the country; ore is known as "rock" or "copper ground' '(if unmined); the product of concentration is known as "mineral;' the term "ore" is used to designate the copper minerals (arsenides, sulphides, etc.) that occur to a limited extent in the district. Large bodies of native copper are known as "mass" and smaller ones are designated as "barrel work." In this report the local terms will be used, as it does not seem desirable to employ the more usual terms to the exclusion of the local, and a mixture of the two is confusing.

[b] The figures are based on the actual recovery of copper from "mineral" smelted and the estimated recovery from "mineral" that was not smelted during 1909.

Production of "rock" and "mineral" and yield in silver and copper in Michigan in 1908 and 1909, by kinds of rock.

	1908.		1909.	
	Amygdaloid rock.	Conglomerate rock.	Amygdaloid rock.	Conglomerate rock.
Silver:				
Fine ounces	241,055		286,430	
Per cent of total	100			
Average yield per ton of rock ounce	0.031		0.025	
Copper:				
Pounds	135,604,144	87,682,556	153,081,219	81,055,310
Per cent of total	60.7	39.3	65.3	34.7
Average yield per ton of rock pounds	17.6	30.9	17.7	28.7
Average yield per cent	0.88	1.54	0.88	1.43
"Mineral:"				
Pounds	193,839,568	145,393,684	220,395,596	138,467,339
Per cent of total	57.1	42.9	61.4	38.6
Average yield in copper per cent	69.9	60.3	69.4	58.5
"Rock:"				
Tons	7,694,994	2,836,277	8,612,259	2,817,135
Per cent of total	73.1	26.9	75.4	24.6

Three counties, Houghton, Keweenaw, and Ontonagon, contributed to the output of copper and silver in 1909. The following table shows the relative importance of these counties in output of copper and silver for 1908 and 1909. It may be noted that the increase in silver is not due to an increase in the silver content of the rock, but to the fact that more copper was electrolytically treated in 1909 than in 1908. The decrease in copper recovered per ton of rock milled is confined to Houghton and Ontonagon counties. The average decrease for the district can be attributed largely to the decrease in recovery from conglomerate rock.

Production of silver and copper in Michigan for 1908 and 1909, by counties.

1908.

County.	Silver.	Copper.			"Mineral."		"Rock."
	Quantity.	Quantity.	Yield per ton of "rock."		Quantity.	Yield.	
	Fine ozs.	*Pounds.*	*Pounds.*	*Per cent.*	*Pounds.*	*Per cent.*	*Tons.*
Houghton	237,692	197,332,438	22.3	1.11	304,755,607	64.7	8,838,014
Keweenaw	595	19,806,216	16.3	.81	26,209,977	75.5	1,213,071
Ontonagon	2,768	6,148,046	12.8	.64	8,267,668	74.4	480,186
Total	241,055	223,286,700			339,233,252		10,531,271
Average			21.2	1.06		65.8	
1909.							
Houghton	285,066	204,843,885	21.4	1.07	318,119,244	64.4	9,546,301
Keweenaw		24,527,685	16.5	.82	33,512,727	73.2	1,478,113
Ontonagon	1,364	4,764,959	11.7	.58	7,230,964	65.9	404,980
Total	286,430	234,136,529			358,862,935		11,427,394
Average			20.5	1.025		65.24	

REVIEW BY COUNTIES.

Under the review by counties it has been customary to give a general summary of the conditions and developments of the individual properties. The late date of issue of the report for 1909 (for reasons set forth in the introduction) has caused this feature to lose much of its value, and it has therefore been greatly abridged. It is hoped that in the report for 1910 the operations at the individual properties will again be summarized.

In the following reviews of the operations at the individual mines of the district during 1909 the statements concerning the quantity, character, and tenor of rock developed, the quantity of rock stamped, the copper recovered per ton of rock stamped, and the cost of production are based on the published reports of the companies. In the few cases where reports are not published, a general statement of the character of operations is made from the best information available.

HOUGHTON COUNTY.

In 1909 the mines of Houghton County produced 204,843,885 pounds of copper and 285,066 ounces of silver, or 87 per cent of the copper and 99.5 per cent of the silver output of Michigan. The county occupies the central portion of the copper belt and contains 15 of the 23 mines that contributed in 1909 to the copper output; 7 of these mines made a production of silver.

The details of the production for 1908 and 1909 are shown in the following table:

Production of "rock" and "mineral" and average yield in silver and copper in Houghton County in 1908 and 1909, by kinds of rock.

	Amygdaloid rock.		Conglomerate rock.		Total and average.	
	1908.	1909.	1908.	1909.	1908.	1909.
Silver:						
Fine ounces	237,692	[a] 285,066			237,692	285,066
Copper:						
Pounds	109,649,882	123,812,575	87,682,556	81,031,310	197,332,438	204,843,885
Per cent, county total	55.6	60.5	44.4	39.5	100	100
Average yield per ton of rock ... pounds	18.2	18.3	30.9	28.7	22.3	21.4
Average yield ... per cent	0.91	0.91	1.54	1.48	1.11	1.07
"Mineral:"						
Pounds	159,361,923	179,651,905	145,393,684	138,467,339	304,755,607	318,119,244
Average yield ... per cent	68.8	68.9	60.3	58.5	64.7	64.4
"Rock:"						
Tons	6,001,737	6,729,166	2,836,277	2,817,135	8,838,014	9,546,301
Per cent, county total	67.9	70.5	32.1	29.5	100.0	100.0

[a] Silver from conglomerate and from amygdaloid rock has not been separated. A large percentage, however, was derived from amygdaloid rock.

The county shows an increase of 7,511,447 pounds of copper and of 47,374 ounces of silver. The increase in the quantity of silver is due to a slight increase in the quantity of copper electrolytically treated.

Calumet and Hecla.—For the fiscal year ending April 30, 1910, the Calumet and Hecla mine produced "mineral" equivalent to 78,652,618 pounds of copper. A total of 2,865,900 tons of rock was stamped, yielding 27.44 pounds of copper per ton. Of this, 2,026,680 tons were from the conglomerate lode, yielding 65,361,816 pounds of copper, or 32.25 pounds per ton, as compared with 25.03 for the fiscal year 1908.

The Osceola amygdaloid produced 834,120 tons of "rock," yielding 13,231,769 pounds of copper, or 15.85 pounds per ton, as compared with 17.06 for 1908. A total of 4,800 tons of "rock" was stamped from the Kearsarge lode, yielding 59,035 pounds of copper. The recrushing plant was completed during the year. The rate of production of this plant is about 2,000,000 pounds per year at a cost of about 4.75 cents per pound.

Tamarack.—Operations for the year at the Tamarack were largely confined to the conglomerate lode. "Rock" to the amount of 689,099 tons was stamped, producing 20,286,174 pounds of "mineral," equivalent to 13,533,207 pounds of refined copper, or 19.6 pounds of refined copper per ton of "rock" stamped. The cost per pound of refined copper was 14.30 cents in 1909, as compared with 15.24 cents in 1908.

Osceola.—During 1909 the Osceola operated the three branches, the Osceola, the South Kearsarge, and the North Kearsarge. The Osceola branch was operated at a loss; the copper content of the "rock" was about 14 pounds per ton, and under existing conditions it was not possible to produce copper at a profit. It was therefore decided to confine operations to the other two branches. The opening on this branch for the year amounted to 5,817 feet.

At the South Kearsarge 1,524 feet of opening was accomplished in about average quality of "rock." The cost of production was lower for the South Kearsarge than for either of the other branches.

At the North Kearsarge 5,643 feet of opening was accomplished, the character of the "rock" being quite satisfactory.

During the year 1,494,845 tons of "rock" was stamped, producing 33,107,579 pounds of "mineral," or 25,296,657 pounds of refined copper. The yield of refined copper per ton of "rock" stamped decreased from 17.1 pounds in 1908 to 16.9 pounds in 1909, and the cost per pound of copper from 10.25 cents in 1908 to 9.47 cents in 1909.

Centennial.—During the year 3,516 feet of opening was accomplished at the Centennial, the "rock" showing a slight increase in copper content over 1908, though the underground conditions at the close of the year were not very encouraging. A total of 196,525 tons of "rock" was stamped, yielding 3,941,820 pounds of "mineral," or 2,583,793 pounds of refined copper. The yield of refined copper per ton of "rock" stamped was 13.15 pounds in 1909, as compared with 12.94 pounds in 1908; and the cost per pound of copper was 15.61 cents, as compared with 18.49 cents in 1908.

Wolverine.—A total of 4,951 feet of opening was made at the Wolverine during 1909, showing practically no change in the quality of "rock." The bottom levels show fully as good grade of rock as the average of the mine.

During the year 373,694 tons of "rock" was stamped, yielding 12,692,610 pounds of "mineral," or 9,995,748 pounds of refined copper. The yield per ton of "rock" treated was 26.75 pounds. The total cost per pound of refined copper was 7.375 cents, as compared with 7.321 cents for 1908.

Franklin.—During 1909 over 7,000 feet of opening was made at the Franklin, developing "rock" of a higher grade than the average for 1908. During the year work on the conglomerate lode was discontinued, and at the close of 1909 operations were confined entirely to the Pewabic lode. A total of 170,546 tons of "rock" was stamped, which produced 3,306,820 pounds of "mineral," yielding 1,615,556 pounds of copper, or 9.47 pounds of copper per ton of "rock" treated.

Quincy.—At the Quincy mine the linear feet of opening work was greater than 1908, when it was nearly 6 miles. The grade of the "rock" developed was about that of former years. The output of 35,025,225 pounds of mineral, yielding 22,511,984 pounds of refined copper, is the largest in the history of the mine. The recovery per ton of "rock" stamped was slightly above that of 1908 and the cost per pound of refined copper, about 9.98 cents, was three-fourths of a cent lower than for 1908.

The "air blasts" that have been a source of trouble in the past caused considerable damage to No. 2 shaft during the year.

Isle Royal.—During 1909 a total of 15,919 feet of opening was accomplished at the Isle Royal. The output of the mine was considerably in excess of 1908. A total of 401,280 tons of "rock" was stamped, yielding 7,926,015 pounds of "mineral," or 5,719,056 pounds of refined copper. The "rock" yielded an average of 14.3 pounds of refined copper per ton, as compared with 13.8 pounds in 1908. The total cost per pound of copper was 16.64 cents.

Baltic.—At the Baltic mine 816 feet of sinking and 9,659 feet of drifting developed the usual amount of good ground. A total of 814,260 tons of "rock" was stamped, yielding 27,421,000 pounds of "mineral" or 17,817,836 pounds of refined copper. The "rock" yielded 21.88 pounds per ton and the cost per pound of copper was 7.98 cents.

Champion.—At the Champion 840 feet of sinking, 12,826 feet of drifting, and 404 feet of crosscutting were accomplished during 1909. The openings made showed a good proportion of copper ground. "Rock" to the amount of 753,908 tons was stamped, yielding 27,851,720 pounds of "mineral," or 18,005,071 pounds of refined copper. The yield of copper per ton of "rock" stamped was 23.88 pounds at a cost of 8.45 cents.

Trimountain.—At the Trimountain mine 1,126 feet of sinking, 8,823 feet of drifting and 802 feet of crosscutting were accomplished. The character of the "rock" developed by this work was not very encouraging. During the year 323,408 tons of "rock"was stamped, yielding 9,118,095 pounds of "mineral," or 5,282,404 pounds of copper. The yield of copper per ton of "rock" stamped was 16.33 pounds, at a cost of 13.89 cents per pound.

Superior.—During the fiscal year ending April 30, 1910, 107,458 tons of ore from the Superior mine was stamped, yielding 2,205,453 pounds of copper, or 20.52 pounds per ton. The greatest development was at No. 1 shaft, where 288 feet of sinking and 5,485 feet of drifting were accomplished. This shaft has reached the seventeenth level. The ground developed shows good copper values, except on the north side where several drifts run into a series of faults.

Rhode Island.—During 1909 a controlling interest in the Rhode Island mine was acquired by the Franklin Mining Company. Development in Rhode Island ground from shaft No. 1 of the Franklin has been encouraging.

Hancock.—Development at the Hancock was continued throughout the year, and substantial additions were made to the reserves of copper ground.

Atlantic.—Development at the Atlantic mine was confined to sec. 16, where a total of 509 feet of sinking, 2,377 feet of drifting, and 2,144 feet of crosscutting were accomplished. The character of the ground exposed by these openings was sufficiently encouraging to lead to a continuation of the development. An accumulated lot of 43,483 pounds of heavy copper from openings on sec. 16 was shipped during the year.

Wyandot.—During the year the Wyandot No. 11 exploratory shaft was sunk to the 700-foot level and a crosscut was extended to the southeast for 700 feet. Several lodes were encountered that show promise, but no considerable amount of commercial rock was developed.

Winona.—During 1909 construction was begun at the Winona on the stamp mill which is being built jointly with the King Philip. Operations at the mine were confined to a limited amount of development, which added to the reserves of copper rock.

King Philip.—During the year 418 feet of sinking, 1,105 feet of crosscutting, and 5,858 feet of drifting were accomplished at the King Philip mine. The character of the "rock" disclosed was similar to that of the earlier development. As already stated, work on the stamp mill was begun during the year.

KEWEENAW COUNTY.

In 1909 Keweenaw County produced 24,527,685 pounds of copper, being 10.4 per cent of the copper produced in the Lake district; no silver was reported. The county occupies the northern part of the Keweenaw peninsula and contains the northern portion of the copper belt. This section of the belt produced considerable copper in the early days of Lake mining, but of late years has furnished a comparatively small percentage of the total output.

The following table shows the production of "rock" and "mineral" and the average yield in silver and copper in Keweenaw County for 1908 and 1909:

Production of "rock" and "mineral" and average yield in silver and copper in Keweenaw County in 1908 and 1909.

Year.	Silver.	Copper.			"Mineral."		"Rock."
	Quantity.	Quantity.	Yield per ton of "rock."		Quantity.	Yield.	
	Fine ozs.	*Pounds.*	*Pounds.*	*Per cent.*	*Pounds.*	*Per cent.*	*Tons.*
1908	595	19,806,216	16.3	0.81	26,209,977	75.5	1,213,071
1909		24,527,685	16.5	.82	33,512,727	73.2	1,478,113

From this table it is seen that in 1909 there was a distinct increase in the tonnage of "rock" treated and in the quantity of copper produced. The copper is derived entirely from amygdaloidal rock, with an average recovery for 1909 of 16.5 pounds per ton, or 0.82 per cent.

Allouez.—At the Allouez, No. 1 shaft was sunk 345 feet to a depth of 2,943 feet, and No. 2 was sunk 488 feet to a depth of 2,714 feet. At No. 1 shaft 5,184 feet of opening was accomplished, and 1,078 feet at No. 2 shaft. During the year 253,049 tons of "rock" was stamped, yielding 6,384,450 pounds of mineral, or 4,031,532 pounds of refined copper, or 15.93 pounds of refined copper per ton of "rock" stamped. The total cost per pound of copper was 13.39 cents for 1909 as compared with 16.81 cents for 1908.

Ahmeek.—In 1909 a total of 1,598 feet of sinking and of 9,644 feet of opening was accomplished in the four shafts. A total of 406,045 tons of "rock" was stamped, producing 12,409,042 pounds of "mineral," or 9,198,110 pounds of refined copper, an average of 22.7 pounds of refined copper per ton of "rock" stamped. The total cost per pound of refined copper for 1909 was 15.48 cents as compared with 12.66 cents for 1908.

Mohawk.—During 1909 a total of 968 feet of sinking and of 12,723 feet of drifting was accomplished. The openings in shafts Nos. 1, 2, and 3 showed no improvement in copper content. The opening in the lower levels of No. 4 and all the work in No. 5 shaft developed better ground, the results in No. 5 being especially encouraging. The new No. 6 shaft, which is intended to command the ground between the No. 5 shaft and the southern border of the property, was sunk 243 feet. A crosscut was made to the lode at the first level (corresponding to the fourth level of the mine). At this point the lode is well charged with copper and makes the outlook for the southern portion of the property encouraging.

During the year, 819,019 tons of "rock" was stamped, producing 14,690,200 pounds of mineral, or 11,248,474 pounds of refined copper, an average of 13.73 pounds of copper per ton of "rock" stamped. The total cost per pound of refined copper, including construction, was 11.207 cents.

Arnold.—A small quantity of mass copper was produced from the "Arnold" ash bed and shipped to the smelter.

Exploration and development.—The operations of the Keweenaw Company during 1909 were restricted to the Medora-Mandon-Resolute tract. Diamond drill cores were taken from several lodes, and a shaft was started to explore the Kearsarge lode, which from diamond drill exploration seemed most promising.

During the year the Cliff mine was transferred from the Tamarack Mining Company to the Cliff Mining Company. Exploration was discontinued in January and was not resumed.

At the close of 1909 both shafts of the Ojibway mine had reached a depth of 1,250 feet. Crosscutting to the lode on several levels and a limited amount of drifting have met with encouraging results.

At the Seneca mine, controlled by the Calumet and Hecla Company, development was continued. The shaft was sunk to a depth of 768 feet. Crosscuts have been extended to the lode at the first and the second levels, but commercial "rock" was not exposed at either of these points. The crosscut at the third level disclosed good copper values.

At the Gratiot, shaft No. 1 was sunk below the fifteenth level and 3,096 feet of drifting was accomplished. The openings show no material change in copper values. No. 2 shaft was sunk below the fourteenth level and 361 feet of drifting disclosed "rock" of poorer grade than that in No. 1 shaft. The Mineral Range Railroad has been extended to the property.

ONTONAGON COUNTY.

In 1909 Ontonagon County produced 4,764,959 pounds of copper and 1,364 fine ounces of silver, or 2 per cent of the copper and 0.05 per cent of the silver produced in the Lake district. Ontonagon County contains the southwestern portion of the copper belt. This portion has not been so thoroughly developed, and consequently the geology is less understood than in the more northern counties. So far as developed, the lodes are more bunchy than to the north and have produced a relatively high percentage of mass copper. The production for 1909 was derived wholly from amygdaloid lodes.

The following table shows the production of the county for 1908 and 1909:

Production of "rock" and "mineral" and average yield in silver and copper in Ontonagon County in 1908 and 1909.

	Silver.	Copper.			"Mineral."		"Rock."
	Quantity.	Quantity.	Yield per ton of "rock."		Quantity.	Yield.	
	Fine ounces.	*Pounds.*	*Pounds.*	*Per cent.*	*Pounds.*	*Per cent.*	*Tons.*
1908	2,768	6,148,046	12.8	0.64	8,267,668	74.4	480,186
1909	1,364	[a] 4,764,959	11.7	.58	7,230,964	65.9	404,980

[a] This does not include small test shipments made late in 1909 from the Lake mine.

From this table it is seen that the county showed a decrease in the production of copper and silver. The copper recovered per ton of "rock" treated also decreased. Developments during the last two years at the Lake and neighboring mines point to an increase in production for the county, though some of the mines can hardly expect to produce at a profit at the present price of copper.

Adventure.—As the result of diamond drill exploration, which had disclosed three amygdaloid lodes, Nos. 1, 2, and 3, carrying copper, a shaft was started early in April at the Adventure mine to explore these new lodes, and at the close of the year had reached a depth of 310 feet.

Considerable work was also done on the new Mass lode and in the Evergreen lode. Both lodes show some copper.

Mass.—Early in the year a new lode was located at the Mass mine 120 feet southeast of the Evergreen lode. This lode was explored from the thirteenth, the fifteenth, and the seventeenth levels of the "A" shaft. A mill test from the seventeenth level showed encouraging results, but the showing at the thirteenth and the fifteenth levels was less encouraging. The lode has also been explored near the surface a mile to the southeast of the "A" shaft, where good rock was encountered.

Michigan.—The explorations at the Michigan mine during the first half of the year were not very encouraging, and owing to the high cost of producing copper shipments were discontinued late in the summer. Development was continued through the remainder of the year.

Victoria.—A total of 3,504 feet of opening was accomplished at the Victoria mine, resulting in the development of copper ground of about the usual grade of the mine, though the rock stoped was somewhat lower than for 1908.

A total of 118,605 tons of rock was stamped in 1909, producing 1,843,152 tons of mineral. The yield per ton of rock was about 10.20 pounds at a total cost of 13.64 cents. For a portion of the year operations were hampered by a lack of sufficient water to furnish power. This condition was due to the unusually dry season and the cost of production should be less under normal conditions.

Lake.—To April 30, 1910, a total of 6,127 feet of opening had been accomplished at the Lake mine, developing ore of an unusually good grade for this section of the district, though not as rich as was indicated from the first mill tests. The shaft had reached the sixth level before the close of the fiscal year. In sinking below the fifth level a new lode was encountered. Drifting on this lode has disclosed some rock of commercial grade. The rock milled to April 30, 1910, yielded 21.064 pounds of copper per ton.

North Lake.—Diamond drilling was continued throughout the year at the North Lake mine, two amygdaloid lodes carrying copper being located.

Indiana.—Work at the Indiana mine was confined to diamond drilling. Two lodes were cut in No. 2 hole; the first was 30 feet in thickness and well mineralized; the second bed showed a thickness of 265 feet, 40 feet on the hanging wall being very rich in copper. The lode also carried good values for 25 feet near the center and fine copper on the foot wall.

MISSOURI.

By C. E. SIEBENTHAL.

PRODUCTION.

The production of lead and zinc in Missouri in 1909 is shown in the following table:

Production of lead and zinc in Missouri in 1909, by districts, in short tons.[a]

District.	Ore.							
	Lead concentrates.				Zinc concentrates.			
	Galena.		Carbonate.		Sphalerite.		Silicate and carbonate.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Southwest Missouri:								
Alba-Neck City	159	$8,308			11,482	$476,588		
Ash Grove-Everton	57	2,402					50	$1,003
Aurora	323	16,524			6,858	282,603	5,496	119,333
Carl Junction	36	1,869			1,237	50,545		
Carthage	11	597			6,896	287,399	307	7,144
Cave Springs	39	2,002			2,639	111,200		
Duenweg-Porto Rico	3,335	176,191	19	$492	18,721	754,028	2,497	62,069
Granby	322	16,361	67	1,340	3,534	147,739	11.007	287,689
Joplin	6,408	337,782	113	3,461	45,963	1,913,835	1,220	25,279
McDowell	5	300			45	1,710		
Oronogo	951	52,580			8,013	320,922		
Sarcoxie-Reeds					3,044	116,969	2,480	63,820
Sherwood	220	12,235			950	41,278		
Spring City-Beef Branch	1,357	75,156	92	2,633	2,530	95,126	2,916	63,128
Springfield	164	8,351			1,480	65,401		
Spurgeon	658	34.586	94	3,198	1,706	64,460	953	23,349
Stotts City	11	656			677	26,694		
Webb City-Prosperity	24,375	1,318,698			109,315	4,528,517		
Wentworth					145	4,303	315	7.065
Zincite	100	5.129			3,747	155,571		
Total	38.531	2,069,727	385	11.124	228,982	9,444,888	27,241	659,879
Central and southeast Missouri	210,620	8,823,297			41	938	1,284	17,334
State total, 1909	249,151	10,893.024	385	11.124	229,023	9,445,826	28,525	677,213
Same, 1908	218,213	8,629,039	664	18,220	198,340	6,800,359	21,601	451,607
Same, 1907	193,528	10,535,890	357	11,764	222,347	9,208,465	18,733	427,146

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[a] In calculating the metal content of the ores from assays, allowance has been made for smelting losses in case of zinc, but not in the case of lead. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, while the value of the metal is calculated from the average daily quotations at New York and St. Louis.

Production of lead and zinc in Missouri in 1909, by districts, in short tons—Continued.

District.	Metal content.			
	Lead.		Zinc.	
	Quantity.	Value.	Quantity.	Value.
Southwest Missouri:				
Alba-Neck City	126	$10,836	6,095	$658,260
Ash Grove-Everton	46	3,956	16	1,728
Aurora	258	22,188	5,508	594,864
Carl Junction	29	2,494	642	69,336
Carthage	9	774	3,731	402,948
Cage Springs	31	2.666	1,353	146,124
Duenweg-Porto Rico	2,674	229,964	10,686	1,154,088
Granby	282	24,252	5,741	620,028
Joplin	5,167	444,362	24,004	2,592,432
McDowell	4	344	26	2,808
Oronogo	758	65,188	4,231	456,948
Sarcoxie-Reeds	....	....	2,483	268,164
Sherwood	176	15,136	502	54,216
Spring City-Beef Branch	1,170	100,620	2,336	252,288
Springfield	134	11,524	808	87,264
Spurgeon	571	49,106	1,221	131,868
Stotts City	9	774	364	39,312
Webb City-Prosperity	19,612	1,686,632	57,903	6,253,524
Wentworth	....	....	187	20,196
Zincite	80	6,880	1,950	210,600
Total	31,136	2,677,696	129,787	14,016,996
Southeast Missouri	128,299	11,033,714	375	40,500
State total, 1909	159,435	13,711,410	130,162	14,057,496
Same, 1908	144,459	12,134,556	107,404	10,095,976
Same, 1907	138,675	14,699,550	116,752	13,776,736

But one company produced copper in Missouri in 1908 and 1909. The copper output is therefore excluded from the tables of production.

The production and value of silver and the quantity of lead concentrates from which produced are given in the following table:

Production of silver in Missouri, 1907–1909.

Year.	Silver.		Lead concentrates, silver-bearing.
	Quantity.	Value.	
	Fine ounces.		*Short tons.*
1907	25,692	$16,957	....
1908	49,131	26,039	26,488
1909	14,188	7,378	31,000

The quantities given in the first column of the foregoing table are those of recovered silver. The silver content of the ores is so small that it is disregarded in the assay and sale of the concentrates. For this reason the smelter reports must be relied upon for the silver production. As may be seen by inspection of the table, the quantity of silver produced in any year bears no direct ratio to the quantity of concentrates smelted during that year. The reason for this is that the silver content is so small in quantity that the silver bullion is stored and refined in batches. If a series of years be taken into account, the concentrates are seen to average about $1\frac{1}{5}$ ounces of silver to the ton. The value is estimated at the average New York price according to the United States mint.

In the following tables showing the tenor of crude ore ("dirt") and concentrates from Missouri it has been considered advisable to segregate the ores of different nature. For instance, the disseminated lead ore from Southeast Missouri differs radically from the lead and zinc ores from the so-called "soft ground" deposits of Southwest Missouri, and these in turn differ from the "sheet ground" deposits of the same region. Each class of ore has its peculiar problems of mining and ore dressing. This fact makes desirable the separate treatment of the statistical data. Some minor discrepancies in the tables are evident which are probably to be attributed to the different methods of obtaining the information in the two years. The average value of the lead concentrates produced in Southeast Missouri in 1908, though calculated directly from the returns of the producers, is probably too low. The fact that the concentrates are mined and smelted by the same company in certain cases is likely responsible for this discrepancy, the concentrates being reported at cost rather than at their commercial value. Generally speaking, the tables reflect very closely the conditions of the industry. For instance, the higher price of blende concentrates in 1909 permitted the mining of crude ore ("dirt") yielding 0.3 per cent less concentrates in the sheet ground and 0.6 per cent less concentrates in the soft ground.

Tenor of crude lead and zinc ore and concentrates produced in southwest Missouri, 1908–9.[a]

	1908.	1909.
"SOFT GROUND."[a]		
Total crude ore........short tons..	2,584,990	3,096,789
Total concentrates in crude ore........per cent..	5.2	4.6
Lead........do....	.5	.4
Zinc........do....	4.7	4.2
Metal content of crude ore........do....	3.0	2.6
Lead........do....	.4	.3
Zinc........do....	2.6	2.3
Average lead content of lead concentrates........do....	79.3	79.7
Average lead content of lead carbonate concentrates........do....	41.8	43.6
Average zinc content of sphalerite concentrates........do....	58.1	59.3
Average zinc content of silicates and carbonates........do....	42.0	38.5
Average value per ton of lead concentrates........	$52.50	$52.37
Average value per ton of lead carbonate concentrates........	$27.44	$28.89
Average value per ton of sphalerite concentrates........	$34.48	$40.85
Average value per ton of silicates and carbonates........	$20.90	$23.74
"SHEET GROUND."		
Total crude ore........short tons..	3,422,976	4,994,123
Total concentrates in crude ore........per cent..	3.4	3.1
Lead........do....	.6	.5
Zinc........do....	2.8	2.6
Metal content of crude ore........do....	2.2	2.0
Lead........do....	.5	.4
Zinc........do....	1.7	1.6
Average lead content of lead concentrates........do....	80.0	80.3
Average zinc content of sphalerite concentrates........do....	57.6	59.5
Average value per ton of lead concentrates........	$53.70	$54.41
Average value per ton of sphalerite concentrates........	$32.59	$41.55

[a] Including also the small production of lead and zinc ores in Central Missouri.

Tenor of crude lead ore and concentrates in southeast Missouri disseminated lead ore, 1908–9.

	1908.	1909.
Total crude lead ore........short tons..	2,747,387	3,389,742
Lead concentrates in crude ore........per cent..	6.7	6.2
Lead content in crude ore........do....	4.2	3.8
Average lead content of lead concentrates........do....	63.6	60.9
Average value per ton of lead concentrates........	$37.71	$41.89

The main lead and zinc producing regions of Missouri are in the southwestern and southeastern parts of the State. The former is the greatest zinc-producing area in the United States. The latter contains the district of the disseminated lead ore, and in 1908 and 1909 exceeded in production the Coeur d'Alene region, which in recent years has held first rank in the United States. The central Missouri district has produced considerable ore in the past, but it is operated sporadically, and in 1908 and 1909 had so small a production that its output is included with that of southeastern Missouri. The silver and copper production of the State is limited to the southeastern district.

SOUTHWEST MISSOURI.

The southwest Missouri lead and zinc area includes the largest part of the Joplin region, the remaining portion lying in southeast Kansas and in northeast Oklahoma. The ore occurs in the Boone formation and in rocks of Kinderhook age, both belonging to the lower Carboniferous. The ore deposits are found in Jasper, Newton, Lawrence, Greene, and adjoining counties. This area produces on the average about four-fifths of the lead and zinc ore raised in the Joplin region.

The lead ores are galena, with a small quantity of lead carbonate, locally known as ''dry bone;'' the zinc ores are sphalerite, or zinc blende, or ''jack;'' zinc carbonate (smithsonite), and zinc silicate (calamine), both of the latter locally called ''silicate.'' The galena contains but a small fraction of an ounce of silver to the ton of lead concentrates, and although ordinarily it is not desilverized, yet occasionally the refineries find it advantageous to add lead from the Joplin region to their charges, without, however, making any record of the silver content. In this way an unknown but small quantity of silver is recovered from southwest Missouri lead ore. The zinc ores, sphalerite, smithsonite, and calamine contain notable quantities of cadmium, being fully as rich in this respect as the zinc ores of Silesia, which are the source of the cadmium production of Europe. The discussion of the cadmium content of these ores is taken up more fully in the chapter of Mineral Resources for 1908 entitled ''Cadmium.''

The ore deposits of the Joplin district vary in character with the depth of mining. The shallower ores beginning at the surface are universally pockety, and are found in residual clays or in ''runs'' in the basal breccias of the region. The breccias and the forms of the ''runs'' are largely, if not altogether, due to solution of the limestone strata. One form of run which is fairly numerous is the ''circle'' deposit, which in the popular view has come to be nearly synonymous with rich deposits. Small veins, vertical sheets, and thin crevice deposits are often met with in prospecting, but unless they develop into stringers leading into paying ore bodies are forgotten in the multitude of rich pockety deposits which the district has yielded. The blanket deposits or ''sheet ground'' are found in the Grand Falls chert member of the Boone formation at depths varying from 125 to 275 feet, depending on the topography and the geologic structure. Below this horizon there are, in the rocks of Kinderhook age, deposits of disseminated ore. They have been struck in prospect shafts or drill holes near Springfield, Aurora, Granby, Carterville, Joplin, Hornet, and Cave Springs, in Missouri; at Galena, in Kansas; and at Quapaw, in Oklahoma.

ORE PRODUCTION.

Mining and milling practice in the Joplin region is so well known through the numerous articles that have appeared in the mining press of the country that but few words are necessary here. The type of mill erected in the district is carefully chosen to fit the needs of the particular kind of ore body to be exploited, and, being based on the evolutionary experience of nearly forty years, is in general wisely selected.

In early days of zinc mining in the district when only the richest runs and pockets of the "disseminated" deposits could be profitably worked and the life of the individual mine was necessarily short, a very simple type of concentrating plant came into use. It was equipped with a rougher jig and a cleaner jig, and had a capacity of 80 to 100 tons of crude ore per 10-hour shift. When a deposit was worked out, the mill could be easily and cheaply moved to another deposit. When the increased price of concentrates made it possible to mine lower-grade ore and the life of the deposits was thereby lengthened, somewhat larger and more complete milling plants came into vogue. Sand jigs and concentrating tables were added to the equipment, and the capacity was raised to 200 or more tons per shift. Such mills, developed by the necessities of local conditions, came to be characterized throughout the lead and zinc regions of the Central States as the "Joplin type."

A further increase in the price of concentrates, and the development of large bodies of low-grade "sheet-ground" deposits, insuring permanence and stability of operation and necessitating every refinement of concentration, has resulted in the modern "sheet-ground mill" with capacity from 350 to 1,000 tons of crude ore per 10-hour shift, driven by steam, natural gas, or electricity, with complete equipment of ore-saving devices and with attendant economies of power, operation, and concentration.

ORE SELLING.

As was noted in the introduction to this chapter, the lead and zinc ores of the Central States when marketed locally are sold on a plan which differs somewhat from the methods in vogue in the Western and other States where more complicated ores prevail. The producer is paid by the ton of concentrates, all ores being sold in that form. The price is arranged on a sliding scale, the foundation of which is the price paid for ores of a certain standard, namely, the "basis." In each of the ores a "basis" is arbitrarily taken which represents as nearly as may be the average metallic content of clean concentrate. In sphalerite or zinc blende concentrate the basis is 60 per cent (theoretical composition, 67 per cent) of metallic zinc, by wet assay or analysis; in the oxidized zinc ores, the carbonate and the silicate, the basis is 40 per cent (theoretical, 52 and 54 per cent) metallic zinc; and in galena concentrates the basis is 80 per cent (theoretical, 87 per cent) metallic lead. The buyer will offer so much for 60 per cent zinc ore which becomes the "base price." If the assay shows the concentrates to vary from the basis, $1 is added to the base price for each per cent of zinc above 60 and $1 subtracted for each per cent less than 60. Deduction is made for moisture, all concentrates being sold on dry, or net, weight. Penalties are exacted for the presence of undesirable elements, as iron, bitumen, barite, fluorspar, etc. One dollar is deducted for each per cent of iron above 1 per cent. The first ore sold from the new Miami district was penalized 2 "per cent," that is, $2 was arbitrarily deducted for the bitumen clinging to the concentrates. The blende concentrates from Miami average about 50 per cent zinc and are penalized $10 per ton for falling 10 "per cent" below the "base," as well as an additional penalty for the iron contents. In practice, however, it has been found that these penalties are heavier than necessary and the ore buyers offset the excess by increasing the base offer over the base price obtaining in the other parts of the Joplin region where the concentrates average nearer 60 per cent. Fluorspar occurs in the zinc concentrates of western Kentucky and southern Illinois, but neither fluorite nor barite are found in quantity in the ores in the Joplin or the upper Mississippi Valley districts. The practice of buying zinc blende concentrates on an assay basis became general in 1899, though it began in a small way a few years earlier. Formerly the ore was bought on "flat bid;" that is to say, the buyer made a visual inspection and mental estimate of the metallic contents and then offered so much per ton for the particular concentrates in question. An expert buyer can estimate the metallic contents very closely. Galena concentrates are generally bought on flat bid, though buying on assay is increasing. Ore which is sold in lump, such as hand-picked galena, lead carbonate, and carbonate and silicate of zinc, is very generally sold on flat bid.

ASSAYS.

Several of the assayers in the Joplin district make a practice of saving the remnants of samples analyzed through the year. At the close of the year the lot is thoroughly mixed and carefully sampled, from which sample an average or composite assay for the year is made. Two representative series of such composite assays are given below. In most cases each sample included in the composite assay represents a carload lot of concentrates.

The first series, by W. W. Petraeus, of Joplin, gives the result of analyses of composite samples from the general district for the last twelve years. The analyses for 1897–1905, inclusive, were published in the Lead and Zinc News, volume 9, January 15, 1906, page 8. The analyses for 1906–1909, were kindly communicated by Mr. Petraeus. Iron was not taken into account until 1900. Some 400 scattering assays, made in 1895–96, are excluded from the table.

Composite assays of zinc blende from the Joplin region, 1897–1908.

[W. W. Petraeus, analyst.]

Year.	Composite sample.	Percentage of zinc.	Percentage of iron.
	Lots.		
1897	600	56.64	....
1898	1,299	56.99	....
1899	3,715	56.67	....
1900	3,500	57.36	0.22
1901	3,683	57.53	2.02
1902	5,776	57.08	2.24
1903	6,014	57.30	2.00
1904	6,220	57.24	2.10
1905	4,628	57.97	1.84
1906	5,644	57.2	2.00
1907	6,813	56.8	1.93
1908	7,837	56.4	1.76
1909	9,002	56.3	2.00

The composite sample for 1905 also assayed: Lead, 1 per cent; copper, 0.001 per cent; cadmium, 0.198 per cent.

The next series of composite assays was communicated by Prof. W. George Waring, of Webb City. The original samples were of ores from the different camps of the district except where otherwise indicated. The methods used in making these assays have been published.[a]

Composite assays of zinc blende from the Joplin region, 1900–1908

[W. George Waring, analyst.]

Year.	Composite sample.	Zinc.	Iron.	Lead.	Cadmium.	Copper.
	Lots.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1900	3,894	57.30	3.03			
1901	5,172	56.00	3.30			
1901	2,757	55.30	3.86			
1901	[a] ±2,000	55.90	3.47			
1902	2,270	57.08	2.65	0.904	0.337	0.050
1903	2,145	57.75	2.32	1.072	.388	.049
1904	[a] 3,800	58.26	2.23	.701	.304	.049
1904	[b] 2,691	58.46	1.97	.720	.430	.050
1904	1,984	58.95	2.10			
1905	4,520	58.95	2.00			
1906	4,638	58.40	2.20			
1906	3,968	58.20	2.29			
1907–8	±4,000	58.70	2.00			

[a] Joplin. [b] Webb City.

The complete analysis of the composite sample of the 3,800 lots of concentrate from the Joplin district in 1904, sampled by C. V. Millar and analyzed by Waring, is as follows:

Analysis of composite sample of zinc blende from the Joplin region.

[W. George Waring, analyst.]

Zinc	58.26	Calcium carbonate	1.88
Cadmium	.304	Magnesium carbonate	.85
Lead	.70	Barium sulphate	.82
Iron	2.23	Silica	3.95
Manganese	.01		
Copper	.049		99.773
Sulphur	30.72		

Both series of composite assays show a slight but gradual increase in the zinc content of the concentrates from the beginning of the series to the present time. The second series indicates a similar decrease in the quantity of iron. Both these changes are doubtless to be attributed to the increased efficiency of mills and milling practice, particularly in the sheet-ground districts. The first series shows indications of a lowering of the grade of concentrates by the custom-mill product of the gougers and scrappers in the latter part of 1907 and in 1908, while many of the large mines were shut down because of the low price of ore.

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[a] Waring, W. George. The volumetric determination of zinc, Jour. Am. Chem. Soc., vol. 26, No. 1, January, 1904. In addition to the composite assays for 1902 and 1903, shown in the table, the article gives the lead, copper, and cadmium content of a number of ores from individual mines in Missouri, Kentucky, and Illinois.

PRICES.

The two charts following show graphically for the years 1908 and 1909 the average price of spelter at St. Louis, the weekly average basis price of 60 per cent zinc concentrates at Joplin, and the weekly production of zinc blende in short tons by the Joplin region as a whole. The price of spelter has been taken from market reports, and the price of zinc blende and the figures of weekly production are those published in the Joplin Globe and the Joplin News-Herald. The sharp weekly fluctuations in production result from the holding back one week for better prices and the heavy selling when prices are higher. The curve, strictly speaking, is that of sales, but throughout this report only that ore which has been marketed is considered in the production. To eliminate these weekly fluctuations and to obtain a curve more easily comparable with the price curves, the weekly sales have been averaged by months, the result being shown by the broken line.

In the main the price of zinc blende closely follows that of spelter, the margin between them being naturally smaller as the price of each falls. Some discrepancies appear here and there, in part the result of scarcity of ore owing to inclement weather, breakage of natural-gas mains, holidays, etc., and in part the result of tariff agitation. Likewise the weekly production bears a close relation to the price fluctuations, especially as shown in the curve of weekly production averaged by months. This relation is somewhat counteracted, however, by the law of supply and demand, high prices resulting from a scarcity of ore, and vice versa.

CENTRAL AND SOUTHEAST MISSOURI.

The ore deposits of central and southeast Missouri reach in a more or less connected belt from the region of Morgan, Moniteau, Cole, and Miller counties on the northwest to the northern and eastern flanks of the St. Francis Mountains on the southeast.

The deposits in the northwestern portion of this belt, corresponding to the central Missouri region, are of the general type of those in the Joplin region, in that the ores consist of galena and sphalerite, or the oxidized derivatives of those minerals, and occur in association with solution breccias and sink-hole shale patches, the ore being found in the Cambrian and Ordovician dolomites and included cherts and occasionally in the shale. The occurrence of ore in crevices or thin vertical sheets is very common, but practically all the production of ore has been from sink-hole breccias or "circles," a form of deposit noted also as important in the southwest Missouri area.

The southeastern part of the belt, in the vicinity of the St. Francis Mountains, forms the disseminated lead region of southeast Missouri. The ore in this region is almost wholly lead, though a considerable deposit of zinc ore occurs at Valle Mines, some 6 miles north of the Bonneterre district, and furthermore copper, nickel, and cobalt ores occur with the lead in the vicinity of Fredericktown in the southeastern portion of the region. The lead ore generally carries some silver, the average being less than 2 troy ounces to the ton of lead concentrates. The ore deposits are almost wholly in the lower part of the Bonneterre limestone, where they occur in disseminated form over large areas, relatively richer in the vicinity of the intersecting

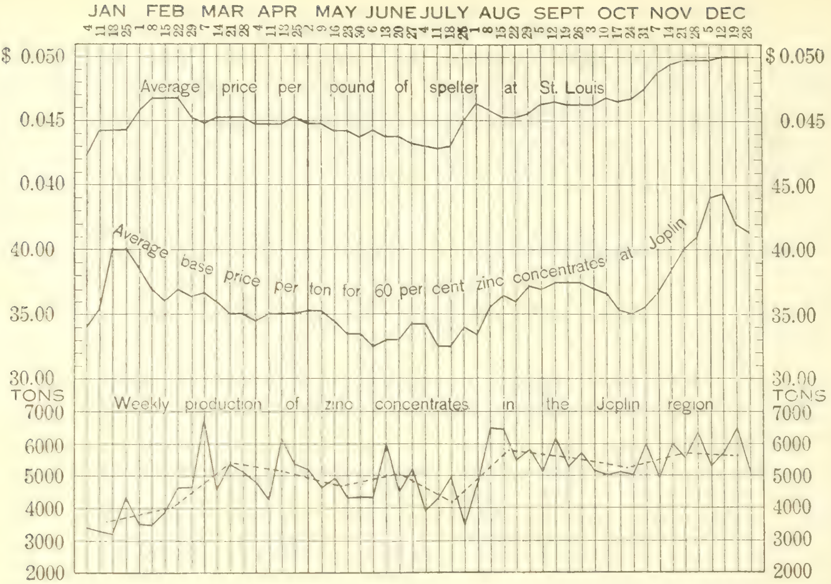

FIGURE 1.—Average weekly prices of spelter and of 60 per cent zinc concentrates, and weekly production of zinc concentrates in the Joplin region in 1908.

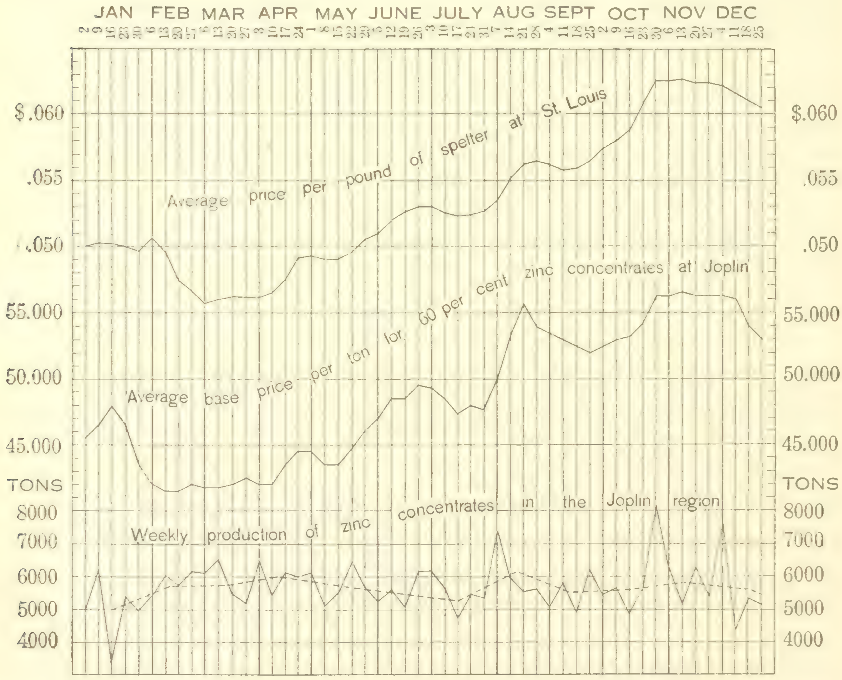

FIGURE 2.—Average weekly prices of spelter and of 60 per cent zinc concentrates, and weekly production of zinc concentrates in the Joplin region in 1909.

crevices and joints. The crevices show little if any displacement, and there are no breccias of consequence. The copper, nickel, and cobalt ores occur with galena and marcasite in blanket formation in the carbonaceous beds of parting at the contact of the Bonneterre limestone with the Lamotte sandstone below, and in the vicinity of the intersection of this contact with the sloping surface of the pre-Cambrian rocks. Both the Bonneterre and the Lamotte formations are of Cambrian age.

The southeast Missouri deposits have been known and worked for about two hundred years. The earlier workings were shallow and even yet considerable shallow lead is raised, generally in connection with the mining of barytes, or "tiff," as it is locally known. The mines in the disseminated lead region range from 100 feet to about 550 feet in depth, depending on the depth from the surface to the basal portion of the Bonneterre limestone. Prospecting is done by means of the diamond drill, and extensive campaigns of drilling have been prosecuted in the vicinity of all the important producing tracts.

The silver production of southeast Missouri was 14,188 fine ounces in 1909, and 49,131 ounces in 1908. The production for 1909 was recovered from about 31,000 tons of lead concentrates and that for 1908 was recovered from 26,488 tons of lead concentrates, each quantity representing less than 15 per cent of the total production of lead concentrates for the respective year. The remaining 85 per cent of the concentrates from southeast Missouri was not desilverized. As explained already the quantity of silver produced during any year bears no direct ratio to the quantity of silver-bearing lead concentrates smelted during that year, for the reason that the silver bullion is stored and refined in batches at convenient times. In a series of years the silver content of the concentrates appears to average about 1⅕ fine ounces to the ton.

The mines of the disseminated lead district of southeast Missouri remain very much as described in Mineral Resources for 1908. In Madison County financial difficulties overtook the Madison Lead and Land Company, which was declared bankrupt and ordered sold under foreclosure proceedings. The Eastern Lead Company, succeeding the defunct Hudson Valley Lead Company, went under foreclosure as a preliminary to clear the way for reorganization.

OKLAHOMA.

By C. E. Siebenthal.

PRODUCTION.

The production of lead and zinc in Oklahoma in 1909 is shown in the following table:

Production of lead and zinc in Oklahoma in 1909, by districts, in short tons. [a]

District.	Ores.								Metal content.			
	Lead concentrates.				Zinc concentrates.				Lead.		Zinc.	
	Galena.		Carbonate.		Sphalerite.		Carbonate and silicate.					
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Ottawa County:												
Miami	1,056	$210,586	......	......	11,569	$361,029	......	......	3,227	$277,522	5,123	$553,284
Peoria	6	246	......	......	......	......	267	$7,348	5	430	93	10,044
Quapaw	244	12,545	......	......	5,015	207,585	38	586	195	16,770	2,542	274,536
Total	1,306	223,377	......	......	16,584	568,614	305	7,934	3,427	294,722	7,758	837,864
Murray County			......	......	......	......	148	2,693	......	......	48	5,184
State total, 1909	1,306	223,377	......	......	16,584	568,614	453	10,627	3,427	294,722	7,806	843,048
Same, 1908	2,236	118,333	......	......	10,038	249,991	280	6,625	1,781	149,604	4,529	425,726
Same, 1907	662	44,771	5	$275	3,076	119,008	650	15,667	532	56,392	1,657	195,526

[a] In calculating the metal content of the ores from assays, allowance has been made for smelting losses in case of zinc, but not in the case of lead. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, while the value of the metal is calculated from the average daily quotations at New York.

The following table gives the crude lead and zinc ore for the whole State of Oklahoma, but it was thought advisable to calculate the tenor of crude ore and concentrates as well as assay content and value of concentrates separately for the Miami and the Quapaw districts, inasmuch as the character of the ground operated in these districts differs so radically that general calculations for the State would be valueless. The marked increase in the value of blende concentrates at Miami in 1909 as compared with 1908 is due to several factors, among which are: The higher grade of the concentrates, less bitumen, and more favorable base offerings on account of high iron content, as well as the prevailing higher price of blende in 1909.

Tenor of lead and zinc ore and concentrates produced in Oklahoma, 1908–9.

	1908.	1909.
Total crude ore .... short tons	225,184	317,574
Miami district:		
Total concentrates in crude ore .... per cent	10.6	9.2
Lead .... do	2.2	2.4
Zinc .... do	8.4	6.8
Metal content of crude ore .... do	5.9	5.3
Lead .... do	1.8	1.9
Zinc .... do	4.1	3.4
Average lead content of lead concentrates .... do	79.8	79.6
Average zinc content of sphalerite concentrates .... do	48.9	50.3
Average value per ton of lead concentrates	$53.28	$51.92
Average value per ton of sphalerite concentrates	$21.56	$31.21

Tenor of lead and zinc ore and concentrates produced in Oklahoma, 1908–9—Continued.

	1908.	1909.
Quapaw district:		
Total concentrates in crude ore.....per cent..	2.8	3.7
Lead.....do....	.3	.2
Zinc.....do....	2.5	3.5
Metal content of crude ore.....do....	1.7	2.2
Lead.....do....	.3	.2
Zinc.....do....	1.4	2.0
Average lead content of lead concentrates.....do....	79.0	79.3
Average zinc content of sphalerite concentrates.....do....	56.8	57.9
Average value per ton of lead concentrates.....	$51.74	$51.41
Average value per ton of sphalerite concentrates.....	$31.02	$41.39

The workable deposits of lead and zinc in Oklahoma, so far as known, are confined to two regions, one in the northeastern portion of the State, within the limits of Ottawa County, and the other in the Arbuckle Mountain region, all of the deposits of the latter region so far productive being located in Murray County.

NORTHEAST OKLAHOMA.

The lead and zinc mines of this section form the southwesternmost extension of the ore deposits of the Joplin region. They occur chiefly in chert breccias, but occasionally in limestone and sandstone breccias. The sandstones belong to the Chester group, the cherts to the Boone formation, and the limestones to either the one or the other, both being of lower Carboniferous age. The ores are galena, sphalerite, or zinc blende, and zinc carbonate and silicate. The galena is practically nonargentiferous, never containing as much as an ounce of silver to the ton of lead concentrates.

At Peoria, the site of the first lead and zinc mining in the State, there were no important developments during the year. In the Quapaw district, the Kansas City-Quapaw Mining Company, operating the Mission mine, completed at the close of the year a 400-ton concentrating mill. The Omaha-Petersburg Mining Company, having thoroughly drilled the M. K. and T. and Ward tracts just north of the Mission mine, consolidated them, and started arrangements to build a 500-ton concentrating plant. These two mills will operate on the blanket ground of the district and will be able to settle decisively whether those ore bodies are commercially available at prevailing prices of lead and zinc concentrates. To the northeast the Good Luck mine opened a fine circular body of zinc ore in open ground.

Miami continued through 1909 the rapid progress begun in 1908 and was the center of the mining activity of the section. The ores are galena and sphalerite in about the proportion of one of the former to three of the latter, no oxidized ores having yet been found. The ores occur at a depth of 90 to 130 feet in sandstone breccias and in flint breccias lying below the sandstone. The sandstone is impregnated with a heavy oil, which, evaporating to asphalt, causes much trouble to save the concentrates, in that it balls up the ores on the jig beds and tends to float off the finer particles of ore. It also has a tendency to lower the grade of the concentrates by enveloping them in films of carbonaceous matter and so causing finely powdered marcasite and pyrite to stick to them. As the scope of mining operations widens, however, there is a noticeable rise in the grade of the concentrates. The average zinc content of the zinc concentrates sold in 1908 was about 49 per cent, the latter half of the year and the first part of 1909 each showing improvement in this respect over the preceding period.

The main ore body so far worked has the form of a long straight run, bearing about N. 30° W. and reaching from the Sunny Jim mine at the southeast to the Emma Gordon mine on the northwest, a distance of 4,300 feet, and shown by the drill to extend at least 2,500 feet in a more northerly direction beyond the Emma Gordon mine, a total known length of about 1¼ miles. Throughout this distance the ore body is in a sandstone breccia, with shale overlying. At places in the run stopes have been taken up in the underlying chert breccia. The width of the run varies from 75 to 150 feet and the height from 8 feet to 13 feet, ranging up to 25 feet where the lower stopes have been taken up. Several other ore bodies have been opened to the west of this run which have their elongation parallel to the run, but none of these as at present developed are at all comparable to the main run in extent.

ARBUCKLE MOUNTAIN REGION.

In the southern part of Oklahoma prospecting for lead and zinc has been prosecuted in the neighborhood of Ravia, at the southeast end of the Arbuckle Mountains, and in Murray County, 8 miles southwest of Davis near the northwest end of the same range, the last-mentioned locality having become productive in 1909. The Arbuckle Mountains consist of a core of pre-Cambrian granites and diabases overlain by the Reagan sandstone, a basal conglomerate formation of Upper Cambrian age, and that in turn by the Arbuckle limestone of Cambrian and Ordovician age, followed by the other formations exhibited by the Paleozoic in that province. The whole uplift is greatly faulted and, especially in the mining district southwest of Davis, is sharply folded. The ore deposits in the Davis area are found in the dolomitic Arbuckle limestone, generally in clay-filled solution channels. All the ore so far shipped has been zinc carbonate from open pits and very shallow shafts. A few shafts are reported to reach a depth of 40 and 60 feet and to have developed deposits of zinc blende. Only two companies, the G. W. Brown Mining Company and the Hope-Sober Mining Company, were shippers in 1909, but development work was active and augured well for 1910.

WISCONSIN.

By C. E. Siebenthal.

PRODUCTION.

The production of lead and zinc in Wisconsin in 1909 is shown in the following table:

Production of lead and zinc in 1909, by districts, in short tons.[a]

District.	Ore.						Metal content.			
	Lead concentrates.		Zinc concentrates.				Lead.		Zinc.	
	Galena.		Sphalerite.		Carbonate.					
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Benton	911	$47,335	12,836	$230,384	......	......	703	$60,458	3,838	$414,504
Buncombe	......	......	385	5,650	......	......	......	......	81	8,748
Cuba City	1,319	73,666	9,841	318,262	......	......	1,067	91,762	3,636	392,688
Dodgeville	57	2,880	503	15,430	156	$1,248	44	3,784	273	29,484
Elmo	364	23,236	213	4,269	......	......	302	25,972	75	8,100
Hazel Green	28	1,416	1,944	41,948	......	......	20	1,720	565	61,020
Highland	568	30,099	2,374	67,996	4,274	53,355	437	37,582	2,313	249,804
Linden	427	23,259	3,337	88,944	......	......	341	29,326	1,269	137,052
Livingston	149	7,780	7,060	130,195	......	......	119	10,234	2,280	246,240
Mifflin	285	15,692	6,576	169,982	......	......	228	19,608	2,456	265,248
Mineral Point	125	6,557	1,210	30,799	700	9,000	100	8,600	651	70,308
Montfort	95	4,954	335	9,802	......	......	76	6,536	133	14,364
Platteville	223	11,454	18,406	383,817	......	......	167	14,362	5,432	586,656
Potosi	10	560	......	......	......	......	8	688	......	......
Shullsburg	98	5,626	401	8,274	......	......	82	7,052	150	16,200
State total, 1909	4,659	254,514	65,421	1,505,752	5,130	63,603	3,694	317,684	23,152	2,500,416
Same, 1908	5,246	277,334	48,155	998,734	3,206	36,579	4,138	347,592	18,206	1,711,364
Same, 1907	4,408	266,471	47,251	997,127	3.065	40,422	3,499	370,894	18,490	2,181,720

[a] In calculating the metal content of the ores from assays allowance has been made for smelting losses in case of zinc but not in the case of lead. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer and that the value of the metal is calculated from the average daily quotations at New York and St. Louis.

Tenor of lead and zinc ore and concentrates produced in Wisconsin, 1908–9.

	1908.	1909.
Total crude ore ......short tons..	475,689	696,389
Total concentrates in crude ore ......per cent..	11.9	10.8
Lead ......do....	1.1	.7
Zinc ......do....	10.8	10.1
Metal content ......do....	5.4	4.3
Lead ......do....	.9	.5
Zinc ......do....	4.5	3.8
Average lead content of lead concentrates ......do....	78.9	79.3
Average zinc content of sphalerite concentrates ......do....	42.6	37.6
Average zinc content of carbonate concentrates ......do....	31.4	33.8
Average value per ton of lead concentrates	$52.87	$54.63
Average value per ton of sphalerite concentrates	$20.74	$23.02
Average value per ton of carbonates	$11.41	$12.40

The lead and zinc mines of Wisconsin are in Grant, Iowa, and Lafayette counties, and comprise the most important part of the ore deposits of the upper Mississippi Valley region. The ore deposits occur in the Galena dolomite and in the upper part of the Platteville limestone, both of Ordovician age. The ores are galena, sphalerite or zinc blende, and smithsonite or zinc carbonate, the latter locally known as "dry bone." As a lead region the district has been known from the earliest settlement days. In time the building of smelters near by made a market for the zinc ores. The first zinc ore to be mined was the carbonate found in association with lead in the shallow workings above ground water level. When all the main deposits were worked out down to water level, there was a lull in mining in the region. Though the carbonate was known to give place to zinc blende and the lead to continue on below water, it was not deemed profitable to mine when continued pumping was necessary. About eight or ten years ago the higher price of zinc led to the opening of some of the deposits below water level, since which time zinc mining has increased until Wisconsin in 1908 and 1909 stood fourth in rank among zinc-producing States. The ore bodies are found in perpendicular, horizontal, or inclined cavities known as "openings" or "crevices," "flats," and "pitches." These openings sometimes extend for considerable distance in a straight line called a "range" and may be operated at different places by different companies. When a range is once established, it becomes an important guide in prospecting.

The galena of the district is nonargentiferous, and so far as known the zinc ores are free from cadmium. In some of the mines marcasite is so plentiful that the zinc blende concentrates are reduced to a very low grade. Owing to their nearness in specific gravity, marcasite and blende are very difficult to separate cleanly by hydraulic methods. Both electrostatic and electro-magnetic separation processes are in operation. Many of the concentrating plants in the district are equipped with roasters and magnetic separators, in addition to which the Joplin Separating Company, at Galena, makes a business of separating low-grade blende-marcasite ores, and the Mineral Point Zinc Company operates a roaster and magnetic separator at Mineral Point. The concentrates, after being dried, are roasted, the customary form of roaster being a long, slowly revolving cylinder lined with firebrick. The roasting is carried far enough to render the marcasite magnetic, but not to drive off all the sulphur, after which the concentrates are passed under the magnetic separator and the iron is removed. The American Zinc Ore Separating Company operates an electrostatic separator at Platteville. It is equipped with driers and both Blake-Morscher and Huff electrostatic separating machines. In this system of separation the expense and attendant losses of roasting are obviated and the separated marcasite finds a market at about $4 per ton. Starting with a capacity of 75 tons daily, it has since been increased to 100 tons daily output. The multiplication of individual and custom roasters, by raising the low-grade ores to high grade, will have a tendency to reduce relatively the tonnage of zinc concentrates, though, of course, the metal content and the value will be less affected; hence these must serve as the basis of comparison for different years.

Milling practice is much as in the Joplin region, except that everything is on a smaller scale in Wisconsin. Many of the mills are from 35 to 50 tons capacity and have but a single jig. Those of 100 tons or over, with rougher, cleaner, sand jigs, and concentrating tables, have generally been built in the last few years. There were about 50 new concentrating plants erected in 1907, many of them being of the larger size. During 1908, mill construction was naturally much less active, and there were but 15 mills completed during the year. In 1909 about 20 mills were set up, though more than half of these were second-hand mills moved to new sites and rebuilt. The crude ore yields from 5 to 20 per cent or more of zinc concentrates. The building contracts, in the case of the larger mills, generally call for a saving of 85 per cent of the blende in the crude ore, but very likely in practice this figure is not often attained. The mining methods are largely determined by the mode of occurrence of the ores, but otherwise are similar to those in vogue in working the pockety ores at Joplin. During the year the Interstate Light and Power Company, which had absorbed several municipal electric lighting plants, and secured franchises, carried well on to completion the construction of a large central power station to supply light and power all over the district.

The zinc carbonate ore is chiefly taken by the Mineral Point Zinc Company and made into zinc oxide in the plant at Mineral Point, Wis. A considerable quantity of the low-grade zinc blende concentrate is used in the same way. Only the higher-grade zinc blende concentrates are sold for manufacture into spelter.

Aside from the development of individual companies, the year was signalized by the initiation of a policy of expansion by three of the larger mining companies. The Wisconsin Zinc Company, affiliated with the American Zinc, Lead, and Smelting Company, operated a number of mines under option to purchase, and prospected a number of tracts, but most of the options were allowed to lapse. The company's main producers during the year were the Acme, Empire, and Mitchell Hollow mines. The first-mentioned was worked out and abandoned.

The Mineral Point Zinc Company, the local subsidiary of the New Jersey Zinc Company, abandoned the separate organization of its mines department under the title of the Mifflin-Linden Mining Company. Large additions were made to the mining lands held by the company in the Highland district, the zinc carbonate ores of which are so desirable for making zinc oxide. A number of mines and farms were purchased in other parts of the Wisconsin field. Of the older mines, which the company owns completely or in part, the largest producers in 1909 were the Coker, Ollie Belle, Kennedy, Winnebago, Franklin, and Highland. The Mason mine was abandoned and the Clark mine lay idle.

The Vinegar Hill Mining Company, previously an important producer in the northern Illinios district, became extensively interested in Wisconsin. In several districts options were taken on mines and lands which were in course of development during the year.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN THE EASTERN STATES IN 1909.

(MINE PRODUCTION.)

By H. D. McCaskey.

INTRODUCTION.

This report is a brief review of the gold, silver, copper, lead, and zinc mining industries of the Eastern or Appalachian States for 1909, and contains the statistics of their production of these metals for that year. The area covered is for the greater part coincident with the broad belt of old metamorphic and associated igneous rocks extending southwest from Vermont to Alabama. The zinc-lead belt of southwest Virginia, however, and its extension southwestward into eastern Tennessee lies to the west of this great metamorphic belt and is contained within the limestone and dolomite of Cambro-Ordovician time.

References were given in the report for 1908 to the most important papers on these mines in the Eastern States, and the geologic relations were briefly described, and this matter will not be repeated here. Copies of that report still remain available for distribution.

In addition to the mines of gold, silver, copper, lead, and zinc ores, which form the main consideration of this report, pyrite mines known to be actually producing copper are taken into account, and the tonnage of chalcopyrite or cupriferous pyrite, given as closely as possible, is, for the purpose of this report, the tonnage of these mines.

The figures herein for the calendar year 1909 have been collected in cooperation with the Bureau of the Census. Since the work of that bureau was in connection with the general census of the United States, the figures obtained through cooperation were collected mainly by field agents of the bureau during visits to the various sections of the country, and this method entailed a greater time than required in other years by the Survey whose direct returns are had largely through correspondence. The late appearance of this report is thus accounted for. In view of this delayed publication no attempt has been made to present the subject in detailed form for 1909, although the essential facts and figures are given as in previous years.

The production set forth in the following tables is based on confidential individual reports by mine operators and may differ in details from that reported for the various metals by smelters, refiners, and the United States Mint. The latter represent the actual production in marketable form of metals treated during the year, and may represent in part ore mined during the previous year; whereas the mine figures aim to give the metal recovery from the ore mined and sold or treated during the year in review. For a given series of years the mine and smelter-refinery-mint figures should closely agree, and for any individual year the lag at the close of the year is usually small, being largely compensated for by a corresponding overlap at the beginning of that year.

The cooperation of mine operators and others of the mining industry with the United States Geological Survey has continued to be most cordial, and is here gratefully acknowledged.

PRODUCTION.

The total value of the production of gold, silver, copper, lead, and zinc in the Eastern States for the calendar year 1909 was $11,818,531. This represents the output of 95 producing mines, of which 48 were gold placers. The gold production was 7,543.60 fine ounces, equivalent to $155,940, and the yield of silver was 66,912 fine ounces, valued at $34,794. Compared with the corresponding figures for 1908, these figures show a decrease of $103,203 in the value of gold production and a decrease of $276 in that of silver. There was a slight increase in quantity in the production of silver in 1909 over that of 1908, owing to a corresponding increase in the production of copper, as the bulk of the silver produced in eastern mines is from copper ores. The value of the silver production, notwithstanding the increase in quantity, was below that of 1908, owing to a lower price for the metal in 1909.

During 1909, 1,465.57 fine ounces of gold and 146 fine ounces of silver were obtained from placer workings, 5,387.19 fine ounces of gold and 711 fine ounces of silver were derived from quartz mines, and 690.85 fine ounces of gold and 66,055 fine ounces of silver were recovered from copper ores. Lead ores were not mined in the Eastern States during the year, and the zinc ores of these States produced no silver nor gold.

There were 25,531 short tons of dry or siliceous ores mined in 1909, with an average gold and silver value of $4.33 per ton, and 787,146 short tons of copper ore, with an average precious-metal value of $0.06 to the ton. In addition to the gold and silver, the copper ores produced 20,354,225 pounds of copper, valued at $2,646,039, and the zinc ores, 166,328,859 pounds of zinc (calculated as spelter), valued at $8,981,758. There was also a production of copper, silver, and gold included above from magnetic concentration of the iron ore of the Cornwall mines in Pennsylvania. The copper production showed an increase of 473,331 pounds in quantity and of $21,761 in value, and the lead production a decrease of 76,190 pounds in quantity and of $3,200 in value, as compared with the corresponding figures for 1908; but the output of zinc increased 29,899,059 pounds in quantity and $2,569,557 in value over that of 1908. During this year a total of 510,172 short tons of zinc ore producing no gold and silver were mined, chiefly in New Jersey, of which part was used directly in the making of spelter, and part was used in making zinc oxide and for other purposes than smelting for spelter, and some of the spelter produced was from treating old tailings from Virginia mines.

The following is a tabulated statement of the production of the Eastern States for 1908 and 1909:

Mine production of gold, silver, and associated metals in Eastern States in 1908 and 1909.

	Gold.		Silver.		Copper.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Fine ozs.		*Fine ozs.*		*Pounds.*	
1908	12,536.04	$259,143	66,170	$35,070	19,880,894	$2,624,278
1909	7,543.60	155,940	66,912	34,794	20,354,225	2,646,039
Increase (+) or decrease (−)	−4,992.44	−103,203	+742	−276	+473,331	+21,761

	Lead.		Zinc.		Total value.
	Quantity.	Value.	Quantity.	Value.	
	Pounds.		*Pounds.*		
1908	76,190	$3,200	136,429,800	$6,412,201	$9,333,902
1909			166,328,859	8,981,758	11,818,531
Increase (+) or decrease (−)	−76,190	−3,200	+ 29,899,059	+2,569,557	+2,484,629

The total tonnage reported as producing the four metals—gold, silver, copper, and zinc—from deep mines in 1909 was 1,322,849 short tons, yielding a total value of $11,788,159. This gives an average total recovered value in metal from deep mines of $8.91 per ton of ore for 1909; the corresponding average value for 1908 was $8.33.

GOLD.

The production of gold in the Eastern States in 1909 was 7,543.60 fine ounces, valued at $155,940 [a]—a decrease in value for 1909 of $103,203 from that of 1908. The most notable decreases were in North Carolina and South Carolina, amounting to more than $40,000 in each case, owing principally to greatly curtailed output of one mine in each State. All the remaining States producing gold, except Alabama, showed increased outputs, the greatest increase being $4,413 in Georgia, which showed the most important decrease in 1908. Of the gold output in 1909 the placers yielded 20 per cent, the quartz ores 71 per cent, and the copper ores 9 per cent.

SILVER.

The production of silver in the Eastern States in 1909 was 66,912 fine ounces, valued at $34,794.[b] As compared with the corresponding production for 1908 an increase of 742 fine ounces in quantity and a decrease of $276 in value are noted. This increase in quantity was primarily due to the increased production of copper ore, the chief source of silver in the Appalachian States. The decrease in value of the silver production was governed by its lessened value per fine ounce. As shown below the total quantity of silver recovered in the Eastern States from sources other than copper ores was very small.

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[a] The value of gold is $20.671834625323 a fine ounce.

[b] The Survey figure for the average value of silver in 1909 is 52 cents a fine ounce. The figure for 1908 was 53 cents.

COPPER.

In 1909 the copper production of the Eastern States was 20,354,225 pounds, valued at $2,646,039.[a] The most important copper mines of these States are the well-known mines of Ducktown, Tenn., which contributed about 94 per cent of the total product during 1909. Alabama produced no copper from pyrite ores mined in 1909; Vermont produced no copper, silver, or gold from the Orange County mines; Maryland and Massachusetts produced but small quantities of these metals; Georgia produced no copper, and in North Carolina and Virginia the mining of copper ores was greatly curtailed. On the other hand, the Milan copper mines of New Hampshire and the Cornwall magnetite mines of Pennsylvania yielded notable additions to the copper output, the latter from the concentration of magnetic iron ores.

In 1908 the copper production of the Eastern States was 19,880,894 pounds, valued at $2,624,278, at the average price of 13.2 cents per pound for that year. The increase of production for 1909 was therefore 473,331 pounds in quantity and $21,761 in value.

LEAD.

The production of lead in the Eastern States, never in recent years of great importance, dropped from 76,190 pounds, valued at $3,200, in 1908, to nothing in 1909. The total quantity of remaining workable lead ore is probably small in the Appalachian States, and there does not seem to be ground, from present information, for the expectation of important future supplies of lead from this region.

ZINC.

The production of zinc as spelter and pigment in the Eastern States in 1909 was 166,328,859 pounds, valued at $8,981,758.[b] This was an increase over the production of 1908 of 29,899,059 pounds in quantity and of $2,569,557 in value. The zinc ores of the Appalachians produce no gold nor silver. The average production of zinc per short ton of crude ore treated was 326 pounds. This ore would average, therefore, 16.30 per cent of recoverable zinc. For 1908 the actual spelter produced only was given for the Eastern States. For 1909 the total zinc production, calculated as spelter, is given as a better measure of the zinc-mining industry. The tonnage, metal output, and value for 1908 have been recalculated for the purposes of comparison, and as herein published will differ from those published in the report for 1908.

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[a] The Survey figure for the average value of copper in 1909 was 13 cents a pound.

[b] The Survey average price for spelter in 1909 was 5.4 cents a pound. The corresponding price for 1908 was 4.7 cents.

Mine production of gold and silver in Eastern States in 1909, by States, in fine ounces.

State.	Gold.		Silver.		Increase (+) or decrease (−) in value compared with 1908.	
	Quantity.	Value.	Quantity.	Value.	Gold.	Silver.
Alabama	1,414.44	$29,239	212	$110	−$11,969	− $39
Georgia	2,932.49	60,620	202	105	+ 4,413	− 1
Massachusetts, New Hampshire, New Jersey, and Pennsylvania.	335.24	6,930	3,493	1,817	+ 2,562	−1,506
North Carolina	1,946.13	40,230	499	259	− 57,265	− 409
South Carolina	534.69	11,053	44	23	− 42,662	− 97
Tennessee	199.21	4,118	57,637	29,971	+ 419	− 608
Virginia	181.41	3,750	4,825	2,509	+ 1,299	+2,384
Total	7,543.60	155.940	66,912	34,794		
Increase (+) or decrease (−) compared with 1908	−4,992.44	−103,203	+742	−276	−103,203	− 276

Source of gold and silver in Eastern States in 1909, by States, in fine ounces.

State.	Gold.			Silver.		
	Placers.	Dry or siliceous ores.	Copper ores.	Placers.	Dry or siliceous ores.	Copper ores.
Alabama	3.34	1,411.10			212	
Georgia	794.95	2,137.54		67	135	
New Hampshire, New Jersey, and Pennsylvania			335.24			3,493
North Carolina	524.77	1,348.60	72.76	75	316	108
South Carolina	69.90	464.79			44	
Tennessee	30.23		168.98			57,637
Virginia	42.38	25.16	113.87	4	4	4,817
Total	1,465.57	5,387.19	690.85	146	711	66,055

Number of producing mines, ore production, and average value of gold and silver per ton in Eastern States in 1909, by States, in short tons.

State.	Number of mines.			Ore production from deep mines and average recovered value in gold and silver per short ton mined.						
					Dry or siliceous ores.		Copper ores.		Zinc ores.	
	Placer.	Deep.	Total.	Total production.	Quantity.	Average value.	Quantity.	Average value	Quantity.	Average value.
Alabama	2	1	3	9,886	9.886	$2.96				
Georgia	15	14	29	8,549	8,549	5.18				
Maryland, New Hampshire, and Pennsylvania		3	3	193,066			193,066	$0.045		
New Jersey		1	1	475,838					475,838	
North Carolina	18	15	33	7,271	3,696	5.07	3,575	6.15		
South Carolina	6	5	11	3,150	3,150	3.06				
Tennessee	2	5	7	611,014			576,680	.06	34,334	
Virginia	5	3	8	14,075	250	2.09	13,825	.35		
Total	48	47	95	1,322,849	25,531	4.33	787,146	.06	510,172	

Mine production of copper, lead, and zinc in Eastern States in 1909, by States, in pounds.

State.	Copper.		Lead.		Zinc.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Maryland, New Hampshire, and Pennsylvania	698,745	$90,837				
New Jersey					165,020,071	$8,911,084
North Carolina	224,512	29,186				
Tennessee	19,206,806	2,496,885			1,192,161	64,376
Virginia	224,162	29,141			116,627	6,298
Total	20,354,225	2,646,039			166,328,859	8,981,758
Increase (+) or decrease (−) compared with 1908	+473,331	+21,761	−76,190	−$3,200	+29,899,059	+2,569,557

Number of copper and zinc producing mines, ore tonnage, and average pounds of metal recovered per short ton of ore in Eastern States in 1909, by States.

State.	Number of mines.		Copper ore.		Zinc ore.	
	Copper.	Zinc.	Quantity.	Average per ton of ore.	Quantity.	Average per ton of ore.
Maryland, New Hampshire, and Pennsylvania	3		193,066	[a] 3.6		
New Jersey		1			475,838	346.8
North Carolina and South Carolina	3		3,575	62.8		
Tennessee and Virginia	3	3	590,505	33.3 16.2	34,334	38.1
Total	9	4	787,146	25.9	510,172	326.0

[a] The ore from Maryland and New Hampshire averaged 41.1 pounds of copper per ton.

THE MINING INDUSTRY, BY STATES.

ALABAMA.

The production of gold and silver in Alabama for 1909 was 1,414.44 fine ounces of gold, valued at $29,239, and 212 fine ounces of silver, valued at $110. This shows a decrease from the production of 1908 of 579 fine ounces of gold, valued at $11,969, and of 70 fine ounces of silver, the total decrease being valued at $12,008. No copper ores nor cupriferous pyrite ores were mined in Alabama in 1909.

The output of silver and gold from Alabama was from two deep and several small placer mines, the total value of the production from the latter source being only $69. The average recovered value from the deep mines in 1909 was $2.96 per ton treated. The total tonnage treated in Alabama in 1909 was 9,886 short tons. The production was almost wholly from the Hog Mountain mine of the Hillabee Mining Company, in Tallapoosa County, as has been the case for several years past. This mine became the largest gold producer in the Eastern States in 1909. The siliceous ores of this mine are in part oxidized and in part contain sulphides, and they are treated in a 120-ton cyanide plant. As mentioned in previous reports, these ores have been the subject of interesting local study and experiments in metallurgical treatment during the last few years. A small production was also reported in 1909 from the Warwick mines, near Talladega, in the county of that name.

The Gold Ridge Mining Company reported development work only in 1909 at its mines in Cleburne and Randolph counties, near Hightower. No production was reported from the pyrite mines near Pyriton, whose ores furnish small quantities of copper as a by-product.

GEORGIA.

During 1909 the production of gold in Georgia was 2,932.49 fine ounces, valued at $60,620, and the production of silver was 202 fine ounces, valued at $105, the total value of the precious metal output for the year being therefore $60,725. By comparison with the corresponding figures for 1908 an increase is noted of 213.48 fine ounces in quantity and of $4,413 in value of gold, and of 2 fine ounces of silver. There was no production of copper or lead in Georgia in 1909, the only mine yielding these metals having been continuously closed down throughout the year. The production of gold from placers in 1909 was 794.95 fine ounces, and of silver 67 fine ounces. The remainder of the output of precious metals, 2,137.54 fine ounces of gold and 135 fine ounces of silver, was all from siliceous ores, of which there were 8,549 short tons mined, yielding an average extraction value of $5.18 per ton. There were 29 mines operated during the year, of which 15 were placers and 14 were deep mines. There was a considerable increase of placer production in 1909 over that of 1908 and a slight decrease in output of metal and an increase in tonnage mined and treated from deep mines. The average recovery value per ton of ore dropped from $7.28 in 1908 to $5.18 in 1909.

REVIEW BY COUNTIES.

Mine production of gold and silver in Georgia in 1909, by counties, in fine ounces.

Counties.	Gold.		Silver.	
	Quantity.	Value.	Quantity.	Value.
Carroll	12.91	$267	....	....
Cherokee and Dawson	1,189.93	24,598	19	$10
Hall and Paulding	113.20	2,340	8	4
Lumpkin	1,013.17	20,944	75	39
Murray and Rabun	22.83	472	6	3
White	169.36	3,501	25	13
McDuffie, Union, and others	411.09	8,498	69	36
	2,932.49	60,620	202	105

Carroll County.—There was again a very small output of placer gold from near Villarica in 1909.

Cherokee County.—No placer production was reported from Cherokee County in 1909. The output of gold was almost wholly from the famous old Franklin mine at Creighton, although a small additional production came from the Cherokee mine in the southern part of the county. Mining operations were discontinued at the Franklin mine in June and the shafts were abandoned. Production has therefore ceased, temporarily at least, at one of the oldest active gold mines in the United States. There was little activity in prospecting or in development elsewhere in Cherokee County in 1909, and the many old mines in this county along the strike of the Dahlonega gold belt remained unproductive.

Dawson County.—There was a small output of placer gold in Dawson County in 1909, resulting from work by the Georgia Dredging Company at the Taylor Creek mine near Dawsonville.

Forsythe County.—There was no production in Forsythe County, but development work was reported at the Big Creek mine.

Hall County.—In Hall County there was a small production of gold from the Glade mine whose stream gravels were worked by dredging.

Lumpkin County.—In Lumpkin County, principally at Dahlonega and Auraria, 7 placer mines produced 396.29 fine ounces of gold and 17 fine ounces of silver, and 8 deep mines made an output of 4,702 tons of ore from which were extracted 616.88 fine ounces of gold and 58 fine ounces of silver. The principal producing mines in 1909 were the Betz, Cresson, Etowah, Barlow, Dahlonega, Singleton, Lockhart, Liberty Bell, and Standard mines. Experiments were conducted at the Betz mine with the Lin washer as a gold saving apparatus and the results appeared to be promising; but the plant of the Piedmont Mining and Milling Company, operating this mine, was destroyed by fire and operations ceased.

McDuffie County.—In McDuffie County the Parks mine continued production of siliceous gold ore. The plant contains a 10-stamp plate-amalgamation mill and Wilfley concentrator.

Murray County.—A small production was reported by the Pack Milling Company from the Juanita mine in Murray County during 1909.

Paulding County.—In Paulding County there was a nominal production of gold in 1909, chiefly from the Peerless mine in the Burnt Hickory district; this mine was worked on a lease, and its plant is equipped with a 10-stamp plate-amalgamation mill and a 100-ton Snodgrass washer.

Rabun County.—In Rabun County there was a small production of gold by the Barclay Mining Company.

Union County.—The Coosa Creek mine in Union County yielded a nominal output of gold in 1909, but the Legal Tender and the Gumlog mines were not worked during the year.

White County.—In White County the Loud placers continued production of gold and production was also reported from the Longstreet and the Jones mines. The White Dredging Company experimented with a small plant with a view to operating on Brown Creek.

MAINE.

There was no production of gold, silver, copper, or lead from operations of mines in Maine in 1909. A number of ore deposits in Hancock, Washington, Somerset, and Oxford Counties have recently been described by Emmons.[a]

MARYLAND.

The New London copper mine, near Monrovia, Frederick County, Md., yielded a small output of copper in 1909 from a shipment made for the purpose of testing the ores. The owner of the mine, the Linganore Copper Company, has been making experiments to determine the advisability of future work.

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[a] Emmons, W. H., Some regionally metamorphosed ore deposits and the so-called segregated veins: Econ. Geology, vol. 4, 1909, pp. 755–781; Some ore deposits in Maine and the Milan mine, New Hampshire: Bull. U. S. Geol. Survey No. 432, 1910.

MASSACHUSETTS.

No copper, lead, silver, nor gold were reported from operations of mines in Massachusetts during 1909. A small quantity of copper is usually credited to this State as a by-product from production of pyrite ores, but none was reported for 1909.

NEW HAMPSHIRE.

In New Hampshire the West Ossipee silver-lead mine, near the town of that name, in Carroll County, was reported idle in 1909. In Coos County, near Berlin, the Milan mine continued to produce copper, silver, and gold from cupriferous pyrites. High-grade ore was shipped direct to smelters and lean ore was milled and concentrated. This mine has recently been studied and described in detail by W. H. Emmons.[a]

NEW JERSEY.

There was no production of copper reported from mining operations in New Jersey in 1909. The Pahaquarry mine across the Delaware from Stroudsburg, Pa., is equipped with a 200-ton concentrating mill; and the Alpha Copper Company reports considerable underground work in the Somerville mine, and the erection of a 100-ton mill.

The well-known mines of the New Jersey Zinc Company, near Franklin Furnace, yielded a materially increased output of ore in 1909, of which 350,978 tons were concentrated and 124,860 tons were shipped to smelters as crude ore. Concentrating and smelting losses being allowed for, the total recoverable zinc from ore mined in New Jersey in 1909 from these mines, calculated as spelter, was 165,020,071 pounds, an increase over the corresponding production of 1908, of 30,689,381 pounds. The mines are opened by a vertical shaft 965 feet deep and a slope down to the 600-foot level. A new incline shaft, at an angle of 47.5° is being sunk 1,500 feet on the slope. The mill includes a crushing department with a 24-hour capacity of 2,240 wet tons and a magnetic separating plant with a capacity of 1,344 wet tons.

NEW YORK.

A small production of gold was reported from New York in 1909; it is said to have resulted from experimental tests of black sands near Croghan, in Lewis County, in the Adirondacks. At the Donovan mine near Macomb, in St. Lawrence County, some prospecting for lead ore was carried on. This mine is reported to be equipped with a 100-ton crusher and 3 Sells jigs.

NORTH CAROLINA.

Mine production of gold, silver, and copper in North Carolina in 1908 and 1909.

Year.	Gold.		Silver.		Copper.		Total value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
	Fine ozs.		*Fine ozs.*		*Pounds.*		
1908	4,716.32	$97,495	1,260	$668	19,393	$2,560	$100,723
1909	1,946.13	40,230	499	259	224,512	29,186	69,675
Increase(+)or decrease(−)	−2,770.19	−57,265	−761	−409	+205,119	+26,626	−31,048

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[a] Op. cit.

The production of gold in North Carolina in 1909 was valued at $40,230, and the value of copper produced was $29,186, a total value of gold, silver, and copper for the year of $69,675. There has been no important production of lead or zinc reported from North Carolina in many years. The production of gold in 1909 was 1,946.13 fine ounces, a decrease from the production of 1908 in this State of 2,770.19 fine ounces in quantity and of $57,265 in value. The production of silver was only 499 fine ounces, valued at $259, but the production of copper was 224,512 pounds. A decrease is therefore shown of 761 fine ounces of silver, and an increase of 205,119 pounds of copper. The total decrease in value of the production of the three metals named amounted to $31,048, or 35 per cent, as compared with the corresponding value for 1908. The increase in value of copper production, however, was over tenfold. North Carolina lost first place in the Eastern States to Georgia in the production of gold in 1909.

In 1909 there were 18 placer mines in operation in North Carolina, or 8 less than in 1908, and the number of deep mines was reduced from 16 to 15, the total number of producing mines being 33. The total ore tonnage raised from deep mines was 7,271 short tons, of which 3,696 tons were of siliceous gold ores and 3,575 tons were of copper ores. This shows a great decrease in gold mining, but an important increase in copper ore mined. Of the total gold production 524.77 fine ounces were from placers, 1,348.60 fine ounces were from quartz ores, and 72.76 ounces were from copper ores. The production of silver from placers in 1909 was 75 fine ounces, and from deep mines 424 fine ounces. The value of the average extraction in precious metals from siliceous ores in North Carolina in 1909 was $5.07 per ton, a decrease in value of $3.81 per ton, and the corresponding value from copper ores was $6.15 per ton.

REVIEW BY COUNTIES.

Mine production of gold, silver, and copper in North Carolina in 1909, by counties.

Counties.	Gold.		Silver.		Copper.		Total value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
	Fine ozs.		*Fine ozs.*		*Pounds.*		
Burke	219.38	$4,535	37	$19	....	....	$4,554
Cabarrus	79.14	1,636	10	5	....	....	1,641
Catawba and Gaston	605.66	12,520	141	73	....	....	12,593
Cleveland	30.57	632	4	2	....	....	634
Franklin, Granville, and Nash	100.67	2,081	4	2	157,056	$20,417	22,500
Jackson, McDowell, and Rutherford	49.58	1,025	110	57	49,000	6,370	7,452
Mecklenburg	18.58	384	1	1	....	....	385
Montgomery and Randolph	142.76	2,951	43	22	....	....	2,973
Rowan	518.92	10,727	110	57	18,456	2,399	13,183
Stanly, Yadkin, and others	180.87	3,739	39	21	....	....	3,760
Total	1,946.13	40,230	499	259	224,512	29,186	69,675

Burke County.—In Burke County there was, as usual, a small placer production from several properties. The Mills hydraulic mine was again the most important producer.

Cabarrus County.—Six producers reported an output of gold in Cabarrus County in 1909, the largest production coming from the dumps of the old Miami (or Phœnix) mine, near Concord.

Catawba County.—In Catawba County the Catawba Gold Mining Company, operating the England and Shuford mines, produced gold and small quantities of silver in 1909.

Cleveland County.—There was a small placer output of gold from operations near Shelby, in Cleveland County, in 1909.

Franklin County.—The Portis mine, near Lewisburg, produced a small quantity of surface gold in 1909.

Gaston County.—A nominal production of gold was reported from Gaston County for 1909.

Granville County.—The Blue Wing copper mine, in the Virgilina district in Granville County, furnished siliceous copper ore to the Ducktown smelters in 1909. This was the most important copper production in the State during the year. The mine is opened by a vertical shaft 356 feet deep, and 460 feet of development was reported for 1909.

Jackson County.—In Jackson County the Cullowhee copper mine yielded copper, silver, and gold in 1909. The mine is developed by a vertical shaft 177 feet deep and by a 4,000-foot tunnel, and is equipped with a plant including a 40-ton water-jacketed Allis-Chalmers copper furnace. The mine was not worked throughout the year, the production resulting from operations of the smelter at intervals during five months of the year.

McDowell County.—In McDowell County there was a nominal output of placer gold in 1909.

Mecklenburg County.—In Mecklenburg County the Southern and the Surface Hill mines yielded small quantities of gold in 1909. The St. Catherine-Rudisil and many other mines of this county were idle.

Montgomery County.—In Montgomery County the Iola mine yielded a greatly decreased output of gold in 1909. This mine of late years has been second only to the Haile mine of South Carolina in point of production; but both the Haile and the Iola mines gave place to the Franklin, of Georgia; and the Hog Mountain, of Alabama, became in 1909 the largest producer of all. The company operating the Iola mine has been recently reorganized, and the plant is reported to have been remodeled and enlarged.

Nash County.—There was a nominal output of gold in 1909 from the Mann-Arrington mine in Nash County.

Randolph County.—In Randolph County the Ashboro mine yielded a nominal production of gold in 1909.

Rowan County.—There was a small output of surface gold from Rowan County in 1909, and a production of gold, silver, and copper from ores mined at Gold Hill. The Southern mine is equipped with a 10-stamp mill and is developed by a 175-foot shaft. The Union Copper Mines Company shipped copper-gold ore and concentrates to smelters on the Atlantic seaboard in 1909.

The ore deposits of the important Gold Hill district have recently been studied and described in detail by Laney.[a]

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[a] Laney, F. B., The Gold Hill mining district North Carolina: Bull. North Carolina Geol. and Econ. Survey No. 21, Raleigh, 1910.

Rutherford County.—There was a nominal production of placer gold from Rutherford County mines in 1909.

Stanly County.—In Stanly County a small output of placer gold was reported from Whitney in 1909.

Union County.—The Bonnie Doon mine, in Union County, near Indian Trail, made no production in 1909, but development work was done and experiments were made in the treatment of low-grade ores. The shaft is 200 feet deep, and the plant includes a slow-speed, 25-ton, Chilian amalgamation and concentration mill.

Yadkin County.—Development work was reported from the Gross and Dixon mines near Cana, in Yadkin County, in 1909, and plans were formed for the erection of a smelter.

PENNSYLVANIA.

In Pennsylvania in 1909 there were an important production of copper and small outputs of silver and gold from magnetic concentration of iron ores of the Cornwall mine in Lebanon County. The Gröndal process is used, and the ores are concentrated in a 500-ton mill, the finished output being briquets, which are shipped to smelters.

SOUTH CAROLINA.

The production of South Carolina in 1909, as compared with that of 1908, showed a decrease of 2,063.77 fine ounces in quantity and of $42,662 in value of gold, of 182 fine ounces in quantity and of $97 in value of silver, and of 1,600 pounds in quantity and of $211 in value of copper. The total production of gold was 534.69 fine ounces, valued at $11,053; the output of silver was 44 fine ounces, valued at $23; and there was no production of copper. The value of the total production for 1909 was $11,076, as compared with a corresponding value of $54,046 for 1908. The production reported for 1909 was from 6 placers and 5 deep mines. During 1908 there were 2 placers and 5 deep mines reporting production. The total quantity of ore reported from deep mines in 1909 was 3,150 short tons of siliceous gold ore yielding 464.79 fine ounces of gold and 44 fine ounces of silver, or an average extraction of $3.06 in value of gold and silver per ton treated.

There were more producers of gold in 1909 than in either 1908 or 1907. The tonnage from deep mines decreased greatly, however, from that of preceding years, and the average extraction value decreased $0.09 per ton from that of 1908.

Abbeville County.—In Abbeville County the Dorn mine produced a small quantity of gold from free-milling ore.

Cherokee and other counties.—There were small placer operations in Cherokee, Chesterfield, Greenville, Lancaster, and Spartansburg Counties in 1909, which resulted in the output of gold from surface mines. The Pacolet mine, in Cherokee County, also yielded a nominal output of gold from this source.

Lancaster County.—In Lancaster County the famous Haile mine, in recent years the largest producer of gold east of the Black Hills, yielded a greatly decreased output and with the Iola mine, of North

Carolina, fell behind the Hog Mountain mine, of Alabama, and the Franklin, of Georgia, in importance of production. This mine has suffered to an unusual degree from accidents involving loss of life and property during recent years, but normal production was resumed in the latter part of 1909.

York County.—The Darwin and the Hardin mines, near Smyrna, in York County, produced small quantities of gold from ore shipped to smelters in 1909.

TENNESSEE.

Mine production of gold, silver, copper, and zinc in Tennessee in 1908 and 1909.

Year.	Gold.		Silver.		Copper.		Zinc.		Total value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
	Fine ozs.		*Fine ozs.*		*Pounds.*		*Pounds.*		
1908	178.94	$3,699	57,696	$30,579	19,459,501	$2,568,654	688,149	$32,343	$2,635,275
1909	199.21	4,118	57,637	29,971	19,206,806	2,496,885	1,192,161	64,376	2,595,350
Increase (+) or decrease (−)	+20.27	+419	−59	−608	−252,695	−71,769	+504,012	+32,033	−39,925

In 1909 the production of gold, silver, copper, and zinc in Tennessee was valued at $2,595,350. As compared with the corresponding figures for 1908, this shows a decrease in value of $39,925. The gold production was 199.21 fine ounces, valued at $4,118; the silver production, 57,637 fine ounces, valued at $29,971; the copper production, 19,206,806 pounds, valued at $2,496,885; and the zinc production, 1,192,161 pounds, valued at $64,376. The gold output, which has been very small in Tennessee, was slightly higher than in 1908. The production of silver was decreased by only 59 fine ounces in quantity, but by $608 in value, owing to the decreased market price of this metal. The copper output showed a decrease of over 250,000 pounds in quantity and of $71,769 in value. The zinc output in 1909 was nearly twice as large as that of 1908 and about six times that of 1907.

The decrease in total tonnage mined was 27,019 short tons, being the difference between a decrease of 42,126 tons of copper ore mined, as compared with the output of 1908, and an increase of 15,107 tons of zinc ore. The total tonnage for 1909 was 611,014 short tons, of which 576,680 tons were copper ore and 34,334 tons were zinc ore. The average copper content of copper ore increased from 31.4 pounds per ton of ore in 1908 to 33.3 pounds in 1909. The corresponding recoverable zinc content decreased from 35.8 to 34.6 pounds per ton.

Jefferson and Knox counties.—In Jefferson and Knox Counties the Grasselli Chemical Company, the Tennessee Mineral Company, and the Kewanee Zinc Company (whose properties were taken over during the year by the Grasselli Company), made an important and increasing production of zinc ore from their mines near Newmarket and Mascot. The ore was zinc blende and carbonate and was concentrated; the concentrates were shipped to Grasselli, Ind., for treatment. Considerable prospecting for zinc ores was carried on by drilling by the Osgood Exploration Company for the American Zinc, Lead, and

Smelting Company Development of zinc deposits near Caswell, McMillan, and Newmarket, was also done in 1909 by John T. Williams & Son and some ore was taken out by them.

Monroe County.—The production of placer gold in Tennessee was, as usual, from the Coker Creek placers in Monroe County, and amounted to about one quarter of the gold production of the State in 1909, the remainder of the gold, and practically all of the silver, coming from refining of the copper produced.

Polk County.—The well-known copper mines at Ducktown, in Polk County, operated by the Tennessee Copper Company, and the Ducktown Sulphur, Copper, and Iron Company, made their usual important output of copper, with small incidental production of silver and gold.

VERMONT.

There was no production of copper, silver, or gold reported from the mines of Vermont in 1909. The Vermont Copper Company, owning the Elizabeth and the Cleveland-South mines, drilled 2,500 feet of exploration with diamond drills and erected a blast furnace and other outside improvements.

VIRGINIA.

Mine production of gold, silver, copper, lead, and zinc in Virginia in 1908 and 1909.

Year.	Gold.		Silver.		Copper.		Lead.		Zinc.		Total value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
	Fine ounces.		*Fine ounces.*		*Pounds.*		*Pounds.*		*Pounds.*		
1908	118.57	$2,451	236	$125	24,775	$3,270	76,190	$3,200	1,410,961	$66,315	$75,361
1909	181.41	3,750	4,825	2,509	224,162	29,141	....	....	116,627	6,298	41,698
Increase (+) or decrease (−)	+62.84	+1,299	+4,589	+2,384	+199,387	+25,871	−76,190	−3,200	−1,294,334	−60,017	−33,663

In 1909 the value of the production of gold, silver, copper, and zinc in Virginia was $41,698, a decrease of $33,663 from that of 1908. The production of gold was 181.41 fine ounces, valued at $3,750, an increase of 62.84 fine ounces in quantity and of $1,299 in value, as compared with the corresponding figures for 1908. The production of silver was 4,825 fine ounces, valued at $2,509, an increase in quantity of 4,589 fine ounces, and in value of $2,384; and the production of copper was 224,162 pounds, valued at $29,141, an increase of 199,387 pounds in quantity and of $25,871 in value. There was no output of lead or zinc reported from the mines of this State in 1909, and the production of zinc recorded is to be credited to reworking of old dumps. There were 5 placers and 3 deep mines producing in 1909, and from the deep mines were reported 14,075 tons or ore, of which 250 tons were of siliceous gold ore yielding precious metal with an average value of $2.09 per ton, and 13,825 tons were of copper ores and pyrite cinder yielding $0.35 in precious metals and 16.2 pounds of copper per ton.

Campbell County.—During 1909 some development work was done by the Rivers Mining and Manufacturing Corporation upon a prospect near Lynch's in Campbell County.

Goochland County.—In Goochland County there was a nominal placer production of gold in 1909, and also a nominal output of gold from the Gilmer mine, near Columbia, from free-milling ore.

Halifax County.—At the Seaboard copper mine in the Virgilina district, in Halifax County, a small quantity of ore was raised during 1909.

Prince William County.—In Prince William County there was a considerable production of copper, silver, and gold, from copper pyrite mined near Dumfries by the Cabin Branch Mining Company and smelted to matte in the company smelter on the Potomac. There was also a small production of these metals from pyritic cinder from pyrite mined at Dumfries and sold for its sulphur content.

Russell County.—The Osborn mine, in Russell County, was prospected by the Virginia Mining and Milling Company in 1909 for lead-zinc ore.

Warren County.—Development work only was reported from the Gooney Manor copper mine, near Front Royal, in Warren County in 1909.

Wythe County.—In Wythe County a small production of zinc resulted from re-treatment of old dumps at Pulaski. There was no zinc ore mined or treated from Virginia during the year.

QUICKSILVER.

By H. D McCaskey.

INTRODUCTION.

The figures herein for the calendar year 1909 have been collected in cooperation with the Bureau of the Census. Since the work of that bureau was in connection with the general census of the United States, the figures obtained through cooperation were collected mainly by field agents of the bureau during visits to the various sections of the country; and this method entailed a greater length of time than is usually required by the Survey, whose direct returns from the producers are had largely through correspondence. The late appearance of this report is thus accounted for. In view of this delayed publication, no attempt has been made to introduce details of geologic field relations, or to give extensive references, although the essential facts and figures of the industry are given as in previous years.

The cordial cooperation of the quicksilver mine operators with the United States Geological Survey is again gratefully acknowledged.

CONDITION OF THE INDUSTRY.

There was a fair domestic demand for quicksilver in 1909 for use in metallurgical processes and in making drugs, pigments, fulminates, and other products, and the price maintained was good throughout the year. Production in California continued to decrease and that in Arizona had ceased in 1908 as that in Utah had in 1907 and that in Oregon did in 1909; but the output of Texas and Nevada increased in 1909, and the total production for the United States was somewhat increased thereby. Imports remained at about the small figure of the preceding two years, but exports, especially to Canada, showed an important increase. Exports to China have practically ceased, but the nearer rather increasing foreign and home markets of the American Continent can probably readily absorb the present small production of this country without greatly decreasing the present price for the metal. The world production does not vary greatly from year to year. On the whole, therefore, the outlook for the industry is better than it has been for several years past.

There was no noteworthy development of the quicksilver resources of the United States in 1909, and from present knowledge of the situation the tendency appears to be rather for the total production to continue slowly to decrease than for it to resume its former rate of output during the bonanza times of the great California mines.

The steady decline of production in that State has not yet been greatly offset by largely increased production elsewhere. The indications, therefore, point to good markets and prices for producing mines remaining in the field.

PRODUCTION.

There were 19 producers of quicksilver in the United States in 1909, of which 15 were credited to California. This is a decrease of 4 producers for the United States and of 3 for California since 1908. The production of quicksilver in the United States in 1909, as obtained from returns from every mine operated during the year, was 21,075 flasks of 75 pounds each, and was valued at $888,710. As compared with the production of 1908—19,752 flasks, valued at $824,146—this shows an increase of 1,323 flasks in quantity and of $64,564 in value. The production of 1909 was 492 flasks below that of 1907 in quantity, but was considerably above it in value; therefore the value of the output of 1909 was the highest for the last three years. The increase of production noted for 1909, due to increased activity in Nevada, Oregon, and Texas, will probably prove but temporary, however, as one important producer in each of these States has closed down, temporarily at least, and the output of California has been slowly declining since 1903.

The following table shows the production, in flasks of 75 pounds each, and the value for the United States for the years 1908 and 1909:

Production of quicksilver in the United States in 1908 and 1909, in flasks of 75 pounds.

State.	1908.		1909.	
	Quantity.	Value.	Quantity.	Value.
Arizona, Nevada, and Oregon[a]	386	$17,170	809	$35,938
California	16,984	684,716	16,078	658,688
Texas	2,382	122,260	4,188	194,084
Total	19,752	824,146	21,075	888,710

[a] Arizona, no production 1909. Output of Nevada for 1909 includes small production in 1908.

TONNAGE AND RECOVERY.

There were mined in 1909 in the United States 182,275 short tons of quicksilver ore, of which 167,292 tons were mined in California, 12,807 tons in Texas, and the remainder in Nevada and Oregon. There were treated 154,502 short tons in the United States, of which 144,989 tons were treated in California, 9,107 tons were treated in Texas, and the remainder in Nevada and Oregon. Comparing these treatment tonnages with recoveries given above it is found that in California the average recovery was 0.4 per cent of the ore treated, or 8 pounds of metal per ton of ore charged into the furnace; in Texas the recovery was 1.7 per cent, or 34.5 pounds of metal per ton; in Nevada and Oregon combined the recovery was 6.5 per cent, or 131 pounds; and for the United States the recovery averaged 0.5

per cent, or 10 pounds per ton, in 1909. The average recovered value per ton of ore treated in the United States in 1909 would, therefore, be only $6.06 at the domestic San Francisco average price of $45.45 per flask.

In forthcoming reports it is hoped that returns from producers may be sufficiently detailed to enable the further subdivision of tonnages and average recoveries according to the different types of furnaces and retorts in use in the United States. Data of the kind, of value to metallurgists and to others interested in the quicksilver industry, will thus be made available for the United States for the first time.

RESOURCES AND DEVELOPMENT.

ARIZONA.

In Arizona there was no production in 1909 from the quicksilver mines of the Colonial Mining Company near Quartzsite, in the Plomosa district, Yuma County.

CALIFORNIA.

During 1909 California produced 16,078 flasks of quicksilver, valued at $658,688. This shows a decrease of 906 flasks in quantity and of $36,028 in value, as compared with the production of 1908. In 1909 California furnished 76 per cent of the total production of the United States, or 10 per cent of the output less than in 1908, 4.8 per cent less than in 1907, and 1.4 per cent less than in 1906.

Below is a table showing the production of California, by years, since 1850:

Total production of quicksilver in California, 1850–1909, in flasks.[a]

1850	7,723	1871	31,686	1892	27,993
1851	27,779	1872	31,621	1893	30,164
1852	20,000	1873	27,642	1894	30,416
1853	22,284	1874	27,756	1895	36,067
1854	30,004	1875	50,250	1896	30,765
1855	33,000	1876	72,716	1897	26,691
1856	30,000	1877	79,395	1898	31,092
1857	28,204	1878	63,880	1899	29,454
1858	31,000	1879	73,684	1900	26,317
1859	13,000	1880	59,926	1901	26,720
1860	10,000	1881	60,851	1902	28,972
1861	35,000	1882	52,732	1903	30,526
1862	42,000	1883	46,725	1904	29,217
1863	40,531	1884	31,913	1905	24,635
1864	47,489	1885	32,073	1906	20,310
1865	53,000	1886	29,981	1907	17,431
1866	46,550	1887	33,760	1908	16,984
1867	47,000	1888	33,250	1909	16,078
1868	47,728	1889	26,464		
1869	33,811	1890	22,926		2,068,147
1870	30,077	1891	22,904		

In 1909 there was a reduced output of quicksilver in Colusa, Lake, Napa, San Benito, San Luis Obispo, Solano, and Sonoma counties, and increased yields, as compared with those of 1908, were reported only from Santa Clara and Trinity counties. The most important producing county in the State for several years past has been San Benito, in which are the New Idria mines. Next in importance is Santa Clara County, with the New Almaden and the Guadalupe mines, followed in order by Napa County with the Napa Consolidated and the Aetna producing mines and by Lake County with the Helen, the Great Western, and two smaller producers.

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[a] 76½ pounds net; 75 pounds net since June 1, 1904.

In all there were 15 producing mines in California in 1909. The total tonnage mined was 158,623 short tons. The quantity of ore treated, which was 144,989 short tons, produced 16,078 flasks of quicksilver, valued at $658,688. The average recovery of metal was, therefore, 8 pounds per ton of ore treated, or 0.4 per cent of the ore. At 61 cents per pound this gives a recovery value of only $4.88 per ton treated, and, with furnace losses allowed for, this indicates that ore carrying only about one-half of 1 per cent of quicksilver can be worked at a profit under favorable conditions and on a sufficiently large scale.

The production of quicksilver in California for 1908 and 1909 is shown by counties in the following table:

Production of quicksilver in California, by counties, during 1908 and 1909, in flasks of 75 pounds.

County.	1908.		1909.	
	Quantity.	Value.	Quantity.	Value.
Colusa	39	$1,700	17	$773
Lake	1,103	46,166	1,065	45,252
Napa	2,420	96,800	1,670	67,000
San Benito	9,610	384,420	8,900	356,000
San Luis Obispo	465	20,730	370	16,659
Santa Clara	2,431	97,240	3,522	151,406
Solano	[a] 465	20,120		
Sonoma	372	14,380	344	14,024
Trinity	79	3,160	190	7,574
Total	16,984	684,716	16,078	658,688

[a] Solano and Fresno combined for 1908.

Colusa County.—In Colusa County the Manzanita mine, of the Sulphur Creek district, made a small production in 1909, but was reported closed down by the end of the year. The Elgin mine, of the same district, a producer in 1908, made no output in 1909.

Fresno County.—In Fresno County the Mercy mines made no production in 1909.

Lake County.—In the Mayacmas district, in Lake County, the Big Injun and the Franklin mines were idle, but the Helen, the Great Western, the Wall Street, and the Bear Canyon mines were all producers in 1909. The Wall Street mine is equipped with a retort plant and the low-grade ores will probably be concentrated before treatment. The Great Western production was partly from final clean-up of the plant, as the mine was closed down in September and the equipment is being dismantled. The pay shoots were reported worked out and no new ore bodies of promise were found in prospecting during the year. The plant includes a 40-ton Litchfield fine-ore furnace. At the Chicago mine, which is equipped with an 8-ton

Scott furnace, some tunnel and shaft work was done and a small lot of ore was raised. The production at the Bear Canyon mine was small and the work was mainly prospecting in 1909. The plant of the Helen mine is a 50-ton Scott furnace. Considerable development work was done at this mine in 1909.

In the Clear Lake district there was no production at the Baker and the Lucitta mines in 1909, and in the Sulphur Creek district there was no output reported from the Abbot group.

Mendocino and Monterey counties.—There was no production of metal reported in 1909 from the Occident prospect in Mendocino County nor from the Table Mountain mines in Monterey County. Considerable ore, however, was made available at the Parkfield and the Kings mines.

Napa County.—In the Knoxville district, in Napa County, the Manhattan and other mines were idle in 1909, but development work was done at the Knoxville mine. No production was reported from the Corona, the Philadelphia, or the Twin Peaks mines, in the Mayacmas district; the Ætna mines in this district made a small output, however, and the Napa Consolidated mine yielded an important production. The latter mine was being closed down during the year, as the ore bodies were considered exhausted, and the Hüttner-Scott fine-ore furnaces, with a daily capacity of 40 tons, were being dismantled. The Bella Union mine, near Oakville, a producer many years ago, was reopened in the fall of 1909.

San Benito County.—In the Central Cerro Bonito district, in San Benito County, a 60-ton Scott furnace was completed at the Bradford mines and development work was done. The Cerro Bonito mine was shut down during all of 1909.

In the Stayton district the Stayton mines were idle during the year.

In the New Idria district, however, in the extreme southeastern part of the county, the New Idria mines continued their successful career as the largest producers of quicksilver on the continent. The plant is equipped with one 40-ton Hüttner-Scott fine-ore furnace and two 40-ton Newcomb coarse-ore furnaces.[a] The Alpine, the Florence-Mac, and the Ramirez mines of this district were all idle. The Aurora mine was developed and considerable ore was reported available for treatment in the new 50-ton rotary furnace, which was being completed at the end of the year.

San Luis Obispo County.—In the Oceanic district, in San Luis Obispo County, the Oceanic mine made an important production in 1909, and in the Adelaide district there was considerable development work at the Sierra Morena mine and a small output from furnace trials. The Oceanic mine is equipped with a Scott furnace, and furnace construction was in process at the Sierra Morena mine. At the Josephine and the Cypress Mountain mines of the Adelaide district development work was done. The Dutro mine was being prospected during the year.

Santa Barbara County.—In Santa Barbara County no activity was reported for 1909 at the Eagle and the Acachuma mines.

Santa Clara County.—The New Almaden and the New Guadalupe mines continued important production of quicksilver throughout 1909. The New Almaden mines are equipped with 5 Scott furnaces, with a total daily capacity of 140 tons, and they have a total development underground of over 115 miles; but the ore treated in 1909 was mainly old dumps of low-grade material rejected in earlier years. The New Guadalupe mines were actively developed and were reported improving as work progressed. They are equipped with 4 Scott furnaces with a capacity of 60 tons. The Phoenix, the San Juan, the Santa Teresa, the Silver Creek, and the Bernal mines in this county were inactive in 1909.

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[a] The New Idria mines were newly described in some detail in the quicksilver report of the Survey for 1908, copies of which can still be had.

Siskiyou and Solano counties.—In Siskiyou County the Minnehaha and the Siskiyou mines in the Oak Bar district made no production in 1909; and in Solano County development work only was done at the St. John mine pending completion of a new 60-ton oil-burning Hüttner-Scott fine-ore furnace, which was erected to take the place of 2 coarse-ore furnaces and 24 pipe retorts. It is expected that costs of reduction will be cut from $2.86 to $0.60 per ton by the improved plant.

Sonoma County.—In the Mayacmas district, in Sonoma County, the Cloverdale and the Socrates mines produced quicksilver in 1909, the former from small operations on sorted ore from old dumps. At the Socrates mine the ore is crushed in a Huntington mill and concentrated in a Woodberry concentrator. Metallic quicksilver is recovered during concentration, and the concentrates from the table are retorted. The Culver-Baer mine made no output in 1909, but development work was carried on with a view to the erection of a large furnace. At the Eureka mines development work was also done, and although no operations were reported from the Great Eastern mines for 1909 it was expected that operations would be resumed. The Pacific, Kirk-Walker, Chapman, Hurley, Napa, Cinnabar-King, Boston, Boulevard, Double Star, Crown Point, and Bacon groups of mines were all reported inactive during 1909. The Clide mine, near the Geysers, was under development.

Stanislaus County.—In Stanislaus County the Grayson, the Stanislaus, and the Deer Park mines made no production in 1909. The Deer Park mine was being developed.

Trinity County.—In Trinity County the Altoona mine produced quicksilver during 1909, but the Integral mines were reported idle during the year.

Yolo County.—In Yolo County there was no production in 1909 from the Reed or the Harrison groups of the Knoxville district.

NEVADA.

Humboldt County.—In Humboldt County, Nev., the occurrence of cinnabar has been known for some time, and has recently been mentioned briefly by Ransome[a] as found in Eldorado Canyon in the Humboldt Range, in American Canyon in the Pahute Range, and on the edge of the Black Rock Desert. Near Fitting, in the American Canyon, are the Nevada Almaden and the Dixie quicksilver properties, on both of which development work has been done. The latter is equipped with a battery of four pipe retorts, in which concentrates will be treated. The ore will be crushed in a Huntington mill and concentrated on Card and canvas slime tables. The crude ore of the Dixie mine is said to average 2 per cent of metal. Development work was also reported from the Ruby mine, near Imlay, in Eldorado Canyon.

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[a] Ransome, Frederick Leslie, Some mining districts of Humboldt County, Nev.: Bull. U. S. Geol. Survey No. 414, 1909.

Nye County.—In Nye County, near Ione, on the west side of the Shoshone Range, the Shoshone mines in Sheep Canyon made a considerable production in 1909 from sorted ore treated in a battery of nine retorts. Development work on three claims near the head of the canyon has exposed an important body of ore, but operations were temporarily suspended pending the erection of a Scott furnace, as the health of the workmen was seriously affected by salivation from fumes of the retorts. In Shamrock Canyon, to the north of Sheep Canyon, development work was also done on the Jule and the Laz claims of the Mercury Mining Company, and a considerable tonnage of good furnace ore was extracted. On the east side of the Shoshone Range, near Bonita, promising quicksilver ore was reported, similar to that near Ione.

OREGON.

In Crook County the Almaden and the American-Almaden quicksilver mines near Prineville were idle during 1909, and prospecting only was reported from the Red Cloud claims in Douglas County.

In Lane County a small production resulted from operations during six weeks in the early part of 1909 at the Black Butte mines, where considerable development work has been done and a new furnace, designed by W. B. Dennis,[a] has been erected.

TEXAS.

In the Terlingua district of Brewster County the important production of quicksilver was recorded for 1909 of 4,188 flasks, an increase over the output of 1908—2,382 flasks—of 1,806 flasks, or over 50 per cent. Of the total production of the United States in 1909 this district of Texas furnished 20 per cent.

This production was from 9,107 short tons of ore treated in 1909, indicating an average recovery of 34.5 pounds per ton treated, or 1.7 per cent of the crude ore.

The following table shows the quicksilver production of Texas by years:

Production of quicksilver in Texas, 1899–1909, in flasks.

1899	1,000	1906	4,761
1900	1,800	1907	3,686
1901	2,932	1908	2,382
1902	5,319	1909	4,188
1903	5,029		
1904	5,336		41,156
1905	4,723		

At Terlingua the Colquitt-Tignor and the Terlingua mines have been idle for several years, but the Marfa and Mariposa and the Chisos mines continued their important production throughout 1909. At Big Bend the Texas-Almaden and the Big Bend mines were unproductive, although promising exploration work was systematically carried on during part of the year at the Texas-Almaden mine. Each of the above-named mines is well equipped with Scott furnaces of the best construction and latest type and the development of the district has been in intelligent and capable hands.

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[a] Dennis, W. B., Shortening the roasting period for mercury ores: Eng. and Min. Jour., vol. 88, July 17, 1909, pp. 112–116.

UTAH.

There was no production of quicksilver in Utah in 1909. The Sacramento mine, at Mercur, Tooele County, which produced in 1906 and 1907, made no output of this metal in 1908 and 1909.

WASHINGTON.

There was no quicksilver output in Washington in 1909, but the Washington Quicksilver Company reported promising development work from its properties in Kittitas County.

WORLD'S PRODUCTION.

The following table gives the world's production of quicksilver, in metric tons, of 2,204.6 pounds, for the years 1903–1909. For foreign countries the quantities given are partly from the corrected figures of the Sixteenth Annual Issue of Comparative Statistics, compiled by the Metallgesellschaft, Metallurgischen Gesellschaft A. G., and the Berg- und Metallbank Aktiengesellschaft, of Frankfort on the Main, Germany; for the United States the figures are those of the United States Geological Survey; and for Spain for 1907 and 1908 they are those of United States Consular Agent A. E. Carleton, published in the Daily Consular and Trade Report No. 3585:

World's production of quicksilver, 1903–1909, in metric tons.

Country.	1903.	1904.	1905.	1906.	1907.	1908.	1909.
United States	1,237	1,188	1,036	892	734	672	717
Austria-Hungary	575	550	570	577	610	630	609
Italy	313	357	369	418	423	680	[a] 700
Russia	362	332	318	210	130	49	7
Spain	968	1,130	853	1,567	1,210	1,065	[a] 1,000
Mexico	188	[a] 190	[a] 190	[a] 200	[a] 200	[a] 200	[a] 200
Total	3,643	3,747	3,336	3,864	3,307	3,296	3,233

[a] Partly estimated.

A steady decrease in the world's production is noted for the last three years, coincident with which there has been a corresponding increase in price. For the last seven years, however, the variations in total production have been, on the whole, rather small.

IMPORTS AND EXPORTS.

According to returns from the Bureau of Statistics, of the Department of Commerce and Labor, the imports of quicksilver into the United States in 1909 remained at practically the insignificant figures of 1908. The exports of 1909, however, were the highest since 1905, both in quantity and in value. The excess in value of exports over imports in 1909 was $258,040, or more than for any other year since 1905.

Quicksilver imported and entered for consumption in the United States, 1905–1909, in pounds.

Year.	Quantity.	Value.
1905	2,690	$1,710
1906	84	50
1907	16,567	6,719
1908	15,113	8,216
1909	15,968	8,203

Exports of quicksilver from the United States, 1905–1909, in flasks of 75 pounds.

Year.	Quantity.	Value.
1905	13,534	$489,756
1906	6,456	243,914
1907	5,132	192,094
1908	2,996	124,960
1909	6,802	266,243

The imports were, as usual, almost wholly into the port of New York. In 1909 there were received into this port 15,200 pounds of quicksilver from England, 25 pounds from Germany, and 178 pounds from Mexico. These figures dispel the apprehension felt at one time during the year that large quantities of quicksilver were being imported for sale, especially from Mexico, during 1909. Within the same period 550 pounds of quicksilver were received into the port of San Francisco from British Columbia.

As the foreign market for domestic production is of much interest to those engaged in the industry, the following tables have been prepared for the purpose of presenting in detail the distribution of exports from the United States during 1908 and 1909:

Exports of domestic quicksilver from the United States in 1908 and 1909, by foreign countries, in pounds.

Country.	1908.		1909.	
	Quantity.	Value.	Quantity.	Value.
Canada	74,231	$38,401	421,136	$214,037
Guatamala	196	110		
Honduras	1,260	698	144	95
Nicaragua	1,951	1,100	4,704	2,839
Panama	84	54	118	70
Salvador	600	348	151	90
Mexico	141,434	81,306	81,035	47,446
Cuba	361	225	165	90
Santo Domingo	90	47	5	4
Brazil	1,224	720		
Colombia	1,413	836	863	495
Ecuador	330	205		
Venezuela	90	43	165	99
Korea	1,275	780	1,054	617
Philippines	153	87	601	361
Total	224,692	124,960	510,141	266,243

The exports to Canada have greatly increased in the last two years; those to Nicaragua and the Philippines have also increased; those to Mexico have shown an important decline; and those to Costa Rica, Peru, Hongkong, and Japan have ceased.

In the following table are given the exports from San Francisco in 1908 and 1909:

Exports of domestic quicksilver from San Francisco in 1908 and 1909, by countries, in flasks of 75 pounds.

Country.	1908.		1909.	
	Quantity.	Value.	Quantity.	Value.
Canada	5	$268	18	$839
Nicaragua	4	130	2	90
Salvador	8	348	2	90
Mexico	1,453	63,436	928	41,134
Korea	17	780	14	617
Philippines	2	87	8	361
Total	1,489	65,049	972	43,131

PRICES.

Prices of quicksilver continued in 1909 the important improvement begun in 1907 and sustained through 1908. In New York the average price per flask for 1907 was $41.50 and the average quotation for domestic quicksilver in San Francisco was $39.60 per flask, and for export $38.17 per flask; in 1908 these average prices had risen, respectively, to $44.84, $44.17, and $42.54; in 1909 they further rose to $46.30, $45.45, and $43.45.[a]

The average price per flask reported by producers to the United States Geological Survey was $38.43½ in 1907, $41.72½ in 1908, and $42.17 in 1909.

In London in 1909 the highest price was £9 17s. 6d. and the lowest £7 19s. per bottle of 34.5 kilos.[b]

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[a] Eng. and Min. Jour., vol. 89, 1910, p. 82.

[b] Comparative Statistics of Lead, Copper, Spelter, Tin, Aluminum, Nickel, Quicksilver, and Silver, compiled by the Metallgesellschaft, the Metallurgischen Gesellschaft A.-G., and the Berg- und Metallbank Aktiengesellschaft, Frankfort-on-the-Main, Sixteenth Ann. Issue, July, 1910, p. 102.

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BAUXITE AND ALUMINUM.

By W. C. Phalen.

BAUXITE.

PRODUCTION.

The production of bauxite in the United States in 1909 amounted to 129,191 long tons, valued at $679,447. The year 1908 was a year of general business depression, and therefore the normal growth of the bauxite industry can be seen by comparing the figures for 1909 with those for 1907 rather than with those for 1908. As compared with the production of 1907, the production in 1909 showed an increase of 31,325 tons, or 32 per cent, in quantity and of $199,117, or 41 per cent, in value. The average price per ton at the mines for the last three years has been: 1907, $4.91; 1908, $5.06; 1909, $5.26. The average price advanced, therefore, 20 cents and 35 cents as compared, respectively, with 1908 and 1907.

The States which produced bauxite in 1909 were Arkansas, Georgia, Tennessee, and Alabama. The industry in Arkansas has shown a phenomenal growth, the production increasing over 200 per cent in 1909 as compared with 1908, and over 70 per cent as compared with 1907. The production of Georgia showed an increase as compared with that of 1908, as did also that of Tennessee, but in the latter State the increase was not marked. The returns for Alabama in 1909 showed a decrease, even from the low figures of 1908.

The following table gives the production and value of bauxite from 1889 to 1909, inclusive:

Production of bauxite in the United States, 1889–1909, by States, in long tons.

Year.	Georgia.	Alabama.	Arkansas.	Total.	Value.
1889	728			728	$2,366
1890	1,844			1,844	6,012
1891	3,301	292		3,593	11,675
1892	5,110	5,408		10,518	34,183
1893	2,415	6,764		9,179	29,507
1894	2,050	9,016		11,066	35,818
1895	3,756	13,313		17,069	44,000
1896	7,313	11,051		18,364	47,338
1897	7,507	13,083		20,590	57,652
1898				25,149	75,437
1899	15,736	14,499	5,045	35,280	125,598
1900	19,739		3,445	23,184	89,676
1901	18,038		867	18,905	79,914
1902	22,677		4,645	27,322	120,366
1903	22,374		25,713	48,087	171,306
1904	21,913		25,748	47,661	235,704
1905	15,173		32,956	48,129	240,292
1906	25,065		50,267	75,332	368,311
1907				[a] 97,776	480,330
1908	14,464		[a] 37,703	52,167	263,968
1909	22,227		[a] 106,874	129,101	679,447

[a] Production of Tennessee included.

CONSUMPTION.

The following table shows the annual production, imports, consumption, and value of bauxite in the United States during the last five years. The importation of bauxite decreased 2,991 long tons in 1909. The average value per long ton of the imported material in 1909 was $4.49. The Payne-Aldrich tariff act of 1909 retained the duty of $1 per ton on crude bauxite.

Production, imports, and consumption of bauxite in United States, 1905–1909, in long tons.

Year.	Production.		Imports.		Consumption.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
1905	48,129	$240,292	11,726	$46,517	59,855	$286,809
1906	75,332	368,311	17,809	63,221	93,141	431,532
1907	97,776	480,330	25,066	93,208	122,842	573,538
1908	52,167	263,968	21,679	87,823	73,846	351,791
1909	129,101	679,447	18,688	83,956	147,789	763,403

WORLD'S PRODUCTION.

The following table shows the world's production of bauxite from 1906 to 1908, inclusive:

World's production of bauxite, 1906–1908, in long tons.

Country.	1906		1907		1908	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
United States	75,332	$368,311	97,776	$480,330	52,167	$263,968
France	115,926	229,952	155,834	323,282	167,991	326,987
United Kingdom	6,654	13,274	7,537	9,137	11,716	14,671
India					(a)	(a)
Total	197,912	611,537	261,147	812,749	231,874	605,626

a Production of 32 long tons; value not available.

NOTES ON THE BAUXITE INDUSTRY.

Arkansas.—The bauxite deposits worked in Arkansas in 1909 are in Saline and Pulaski Counties and are controlled chiefly by the American Bauxite Company, but there are holdings by the Republic Mining and Manufacturing Company and the National Bauxite Company. The company last named produced no bauxite in 1909.

Alabama and Georgia.—The Alabama-Georgia bauxite district extends along the Coosa valley from the vicinity of Summerville or Adairsville, in Georgia, to Jacksonville, in Alabama, and lies chiefly in Bartow and Floyd Counties, Ga., and Cherokee County, Ala. Not the whole of the district is developed or even well prospected, so that from time to time new deposits may be discovered. In Alabama operations were conducted in 1909 by the Republic Mining and Manufacturing Company in the vicinity of Rock Run and by the American Bauxite Company, whose headquarters are at Cave Spring, Ga., near the State boundary line. In Georgia operations in this district during the year were confined mostly to Floyd and Bartow counties. In Floyd County the American Bauxite Company, the National Bauxite Company, and the Republic Mining and Manufacturing Company were active. In Bartow County John H. Hawkins, the Howard Hydraulic Cement Company, and the Cherokee Mining Company produced during the whole or part of the year. The last two companies are the latest additions to the list of bauxite producers. R. A. Asbury, a new producer, reports work at the Gordon and Culbertson mines, located near Cave Spring.

Bauxite field in central Georgia.—In the report for 1907 on the occurrence of bauxite, a note was given on a new field in Wilkinson County, Ga., Since that time, this new field has been studied in much greater detail by Otto Veatch, of the Geological Survey of Georgia,[a] from whose article the following notes are in part abstracted and in part quoted.

The deposits are in no way connected with those of northwestern Georgia, either geographically or geologically, being located 150 miles distant and near the margin of the coastal plain. Macon is the nearest city, located 30 miles to the west. The bauxite apparently occurs near the contact between the Tuscaloosa (Lower Cretaceous) and Claiborne (Tertiary) formations, which are chiefly made up of unconsolidated clays and sands, lying practically flat and having no pronounced structural features. The bauxite occurs in the form of beds either resting directly upon the Cretaceous clays or disseminated as nodules through them. Bauxite beds 10 feet thick have been observed.

The ore is generally either pisolitic or concretionary, but it is also amorphous, in which case it may be dense, halloysitic, or even flinty in appearance. Its color varies from almost white or cream to a bright red. It is generally hard, and no soft, granular, or claylike varieties have yet been discovered.

The following analyses, made by Edgar Everhart, chemist of the Geological Survey of Georgia, show the composition of the ore:

Analyses of bauxite from Wilkinson County, Ga.[b]

No.	Al_2O_3	Fe_2O_3	SiO_2	TiO_2	H_2O	Moisture.	Undetermined.
1	52.92	7.66	10.17	2.30	26.55	0.35	....
2	57.58	.96	9.38	2.76	29.12	.35	....
3	41.97	18.24	17.50	2.65	16.38	2.65	0.16
4	57.36	1.94	.90	3.65	32.44	.67	3.04
5	42.73	14.99	15.57	1.84	20.29	2.79	....
6	61.77	1.67	.90	2.26	31.77	.95	....
7	60.64	1.33	2.30	2.00	30.58	2.79	....
8	61.00	1.94	.74	2.66	32.93	.46	....
9	60.54	1.94	1.96	2.01	32.51	.35	....
10	62.46	.81	4.72	.23	31.03	....	....
11	49.94	9.32	8.32	1.98	27.24	1.94	....
12	39.92	16.84	20.00	1.47	19.52	1.25	....
13	60.55	1.89	2.12	1.96	32.97	....	....
14	61.52	1.70	1.18	2.70	32.76	....	.14

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[a] Veatch, Otto, The bauxite deposits of Wilkinson County, Ga.: Bull. Geol. Survey Georgia No. 18, 1909, pp. 430–447.

[b] Analyst, Edgar Everhart.

According to Veatch:[a]

The origin of the bauxite is obscure. The geological conditions under which it formed were evidently different from those of the Georgia-Alabama and the Arkansas districts, and it is not believed that the theories advanced in explanation of those deposits are applicable to the Wilkinson County bauxite.

The close association of the Wilkinson County bauxite with the white clays and sedimentary kaolins of the Cretaceous at once suggest these clays as the source of the alumina of the bauxite. The facts collected in the field and the chemical analyses favor most strongly the theory that the bauxite has resulted from a chemical alteration in place of pure clays. The following analyses suggest a gradation from clay to bauxite:

Analyses showing gradation of clay to bauxite.[a]

	1	2	3	4	5	6
Moisture	0.35	0.89	0.78		0.33	
H_2O	13.70	14.10	14.54	18.12	29.10	32.97
Al_2O_3	38.24	39.34	40.91	43.50	55.21	60.55
SiO_2 (total)	45.39	[b]43.57	[c]41.21	33.34	12.40	2.12
SiO_2 (sand)[d]	.93	1.12	5.63			
Fe_2O_3	1.01	.72	.81	1.89	.96	1.89
TiO_2	1.76	1.61	1.52	1.53	2.15	1.96
CaO	.10	None.				
MgO	Trace.	.10	.12			
Na_2O	Trace.	.05	.04			
K_2O	Trace.	.10	.24			
Total	100.55	100.48	100.17	98.38	100.15	99.49

[a] Analyst, Edgar Everhart.
[b] Soluble silica 5.28 per cent.
[c] Soluble silica 4.82 per cent.
[d] Not included in the respective footings.

All of the samples are from Wilkinson County. No. 1 is an unaltered white clay and is representative of extensive beds which occur in Wilkinson and adjoining counties. Nos. 2 and 3 are semi-indurated clays, which contain coarse nodules and concretions and have the appearance of bauxite; Nos. 4 and 5 show a further decrease in silica; and No. 6 is a relatively pure bauxite. The silica in Nos. 4, 5, and 6 exists mainly in combination with alumina as clay and partly as soluble silica, but does not exist in appreciable percentages as free silica or quartz sand.

In the field samples of clay may be observed which in their physical appearance suggest an alteration process to bauxite. These clays are semihard, mealy, and have lost some of their plasticity; they contain both nodules without concretionary structure and concretions, giving the whole the appearance of bauxite. Analyses show, however, not only a small excess of alumina over silica, but also that a part of the silica exists in a soluble form. These clays form the upper part (in contact with the Tertiary) of massive nonlaminated white clay beds, which may reach a thickness of 30 feet. The lower part of these beds is structureless soft clay; but there is no sharp line between the two. Frequently the nodules and concretions weather out of the clay, giving the clay a pitted and honeycombed appearance. At one locality irregularly shaped nodules of bauxite were scattered through the soil and were evidently derived by a weathering-out process, probably from a bauxite clay. Concretions have been observed which, though possessing a distinct concentric structure, seem to be kaolin. It is not unlikely that these concretions upon closer examination will show a high percentage of soluble silica, or silica not in combination with alumina as in kaolin. Specimens may also be obtained which are part clay and part bauxite and not simply mechanical mixtures which may have resulted after the formation of the bauxite.

Bowlders of relatively pure bauxite, together with fragments of pitted clay, are very often found in the soil lying upon the beds of honeycombed or pitted kaolins.

Assuming, then, that the bauxite was derived by a chemical process from the clay, what was the chemical solvent which affected the change and under what conditions? The manner in which a relatively pure clay or kaolin could be decomposed with the formation of bauxite confessedly offers a difficult problem. The most satisfactory conclusion which the writer can come to, considering the limited opportunity of collecting facts, since the bauxite is as yet wholly undeveloped, is that the kaolin and other clay may have been altered by circulating highly alkaline waters of meteoric origin. The alkaline carbonates, as sodium carbonate or bicarbonate, $NaHCO_3$, may have been formed by the action of carbonic acid on alkaline silicates or other alkaline salts in the overlying Tertiary, and being taken into solution by circulating waters issued as springs near the contact of the Tertiary with the impervious white clays of the underlying Cretaceous. The action of the sodium carbonate on the kaolin would result in the desilication of the kaolin with the formation of a sodium silicate, leaving an aluminous hydroxide in a gelatinous or colloidal condition. The action of alkaline carbonates upon the clay would take place more readily were the waters carrying them in solution heated.

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[a] Op. cit., pp. 436-430.

The conclusion is that the bauxite has been derived by the action of a decomposing agent upon the clay, whatever this chemical may have been or its source. Certainly, this chemical must have been a more powerful solvent than carbonic acid, and the alteration was effected by other than simple weathering agencies. The possibility of thermal waters derived from the near-by igneous rocks of the Piedmont Plateau or those underlying the sediments effecting the alteration was considered; but under the geologic conditions this seems to have little evidence in its favor. Waters carrying sulphuric acid would be capable of decomposing the clay; but the source of the acid would be difficult to explain, since, so far as known, the overlying Tertiary and the Cretaceous contain no appreciable amounts of sulphur compounds.

A number of occurrences have been reported. The principal localities where bauxite has been found are: (1) Three miles northeast of McIntyre, on the property of Mrs. W. R. Parker, J. R. Honeycutt, W. E. Honeycutt, and James Daniel; (2) 5 miles north of McIntyre, on the property of J. U. Parker; (3) at McIntyre station, on the property of Dr. W. A. Parker; (4) 3 miles west of McIntyre, on the Holleman property; (5) 3 miles east of McIntyre, on the property of R. W. Adkins; (6) 3 miles west of Toomsboro, on the property of Dr. N. T. Carswell; (7) on the old Chambers place, 1½ miles southwest of Irwinton; (8) on the J. R. McNeal place, 5 miles west of Irwinton; (9) 6 miles southeast of Gordon, on the Vincent property, owned by W. A. Jones, of Gordon; (10) on the property of Mrs. Z. T. Miller, 3½ miles south of Gordon; (11) on the farm of J. I. Etheridge, 2 miles southeast of Coopers Station.

For a full description of the various localities enumerated the reader is referred to Veatch's article cited above.

The points at which the bauxite is most likely to occur may be approximately located by finding the white-clay beds, locally known as the "chalk" beds, as the bauxite has been found contiguous to the clay and near its contact with the overlying red sands and impure clays. The geologic conditions obtaining in Wilkinson County are also found in Twiggs, Washington, Glascock, McDuffie, and Richmond Counties, and bauxite may be found in any or all of these.

Tennessee.—The bauxite deposits in Mission Ridge, near Chattanooga, were worked during most of 1909 by the National Bauxite Company at the pit known as Perry No. 2. The work has been pushed to a depth of about 60 feet below the surface and the ore still continues good. Some prospecting has been done, and the approximate size of the deposit at the surface is known. The company is working the side of the pit farthest away from the hill, at places where the overburden is lightest. Some of the overburden has been stripped eastward toward the highway. An incline and a stationary engine are employed to bring the ore from the pit, the cars used holding about one-half ton of ore each. An average daily force of about 25 men is employed. The ore from the mines is carted under contract to Sherman Heights, where it is placed in cars, and from this place a belt line transfers the cars to the various railroads out of Chattanooga and returns the empties.

ALUMINUM.

MARKET PRICES, PRODUCTION, AND CONSUMPTION.

In the report on the aluminum industry for 1908 the statement was made that about the 1st of October, 1908, the agreement among the producers of aluminum in Europe expired, and that on account of the great excess of productive capacity and the accumulation of a large unsold stock strong competition developed and prices fell to 13½ to 14 cents per pound. It is significant that the prices of the American metal during the later half of October, 1908, were considerably reduced, and were afterward still further reduced, until at the end of November the following prices were quoted: 24 cents as the base price for No. 1 ingots, and 33 to 34 cents as the base price for sheets. Foreign metal was offered at 22 cents for ingots. The range of the American market was, therefore, from 22 to 24 cents, while in Europe the metal was quoted at 13½ to 14 cents. These prices were maintained during December, 1908, and the year 1909 opened with prices on domestic and foreign aluminum the same as during November and December, 1908. The foreign market was demoralized during the early part of January, and prices ranged as low as 21½ to 22 cents for ingots; even at these prices the domestic sales were small. These prices, both foreign and domestic, continued until the middle of April, at which time the base price of No. 1 ingots ranged from 22 to 24 cents and that of wire from 31 to 32 cents, the base price of sheets remaining at 33 to 34 cents. These prices continued until the middle of July, when ingots were offered in market at 23 cents, with foreign metal obtainable at 20½ cents, duty paid.[a] In Europe the metal had been selling for some time at 12 cents, but the prices changed slightly during July. Toward the end of that month quotations on ingot metal ranged from 20 to 23 cents, the higher price being that of the American producer. These prices held until the end of the year, and also during the month of January, 1910.

According to the Engineering and Mining Journal,[b] the break-up in the aluminum market in Europe following the dissolution of the agreement of European producers has had rather disastrous results. Several of the manufacturers are reported to have been obliged either to close or to go into bankruptcy. It is claimed that the competition which followed the abrogation of the convention forced prices down below the cost of production. In the United States during the price war abroad aluminum has been offered at prices as low as the duty would permit, but it does not appear that these offers have caused any considerable increase either in domestic sales or in foreign imports. They have, however, had the effect of reducing prices fully one-third, and thus establishing a new level from which no great advance will be possible.

The present prices of aluminum put the metal in a class with copper and tin. According to weight, aluminum is cheaper than tin; according to bulk, it is cheaper than either copper or tin. Such a condition of affairs must result in greatly stimulating the consumption of the metal. It is generally conceded, in view of the increased capacity among the European producers and of the expiration of domestic patents which have hitherto prevented competition, that the present prices are approximately the ones around which future prices will range. The magnitude of the aluminum industry is shown by the following table, which gives the production since the beginning of the industry in 1883:

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[a] Under the Payne-Aldrich tariff act of August, 1909, aluminum, aluminum scrap, and alloys of any kind in which aluminum is the component material of chief value, in crude form, are dutiable at 7 cents per pound, and plates, sheets, bars, and rods at 11 cents per pound instead of 8 cents and 13 cents, respectively.

[b] This paragraph was compiled from the Engineering and Mining Journal for September 4, 1909, pp. 465-466.

Production, in pounds, of aluminum in the United States, 1883–1909.

1883	83
1884	150
1885	283
1886	3,000
1887	18,000
1888	19,000
1889	47,468
1890	61,281
1891	150,000
1892	259,885
1893	333,629
1894	550,000
1895	920,000
1896	1,300,000
1897	4,000,000
1898	5,200,000
1899	6,500,000
1900	7,150,000
1901	7,150,000
1902	7,300,000
1903	7,500,000
1904	[a] 8,600,000
1905	[a] 11,347,000
1906	[a] 14,910,000
1907	[a] 17,211,000
1908	[a] 11,152,000
1909	[a] 34,210,000
Total	145,892,779

Exports.—The value of the exports of aluminum and of manufactures of aluminum of domestic production for the last five years has been as follows: 1905, $290,777; 1906, $364,251; 1907, $304,938; 1908, $330,092; 1909, $567,375.

PROGRESS OF THE ALUMINUM INDUSTRY.

RECENT PATENTS.

In consequence of the great demand for the metal the Aluminum Company of America made extensive additions to its plant equipment in 1907. This great increase in plant capacity was followed by the business depression of the fall of 1907, as a result of which there have been few new developments to record since the beginning of the year 1908, the completion of projects already under way excepted. In the matter of inventions, however, the aluminum industry has kept pace with its former records. Perhaps the most interesting recent inventions are a group patented in December, 1908, by F. J. Tone, superintendent of the Carborundum Company's works at Niagara Falls, which have for their object the production of silicon from kaolin and the formation of pure alumina as a by-product. Calcined kaolin (clay) is mixed with carbon in the electric furnace. Under proper regulation of the heat, the oxygen of the silica becomes absorbed, which results in the production of elementary silicon; iron oxide, if present, is reduced to metallic iron; and titanium oxide is reduced to metallic titanium. The alumina thus purified from metallic oxides remains behind unreduced. If iron is mixed with the charge, ferrosilicon is obtained. The reactions reduced to their simplest forms are as follows:

$$Al_2O_3,\ 2SiO_2 + 4C + Fe = Al_2O_3 + FeSi_2 + 4CO$$

and

$$Al_2O_3,\ 2SiO_2 + 4C = Al_2O_3 + 2Si + 4CO.$$

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[a] Consumption.

According to Tone, the silicides produced in this process are useful for various purposes, such as the refining of iron and steel, and the alumina is useful both as an abrasive and also as an ore for the production of metallic aluminum. Thus the way appears to be opened for the production of metallic aluminum from kaolin or clay, a goal that has been long sought by many experimenters.

RECENT APPLICATIONS OF ALUMINUM.

Recent progress in the application of aluminum in the industries has been summarized by Joseph W. Richards.[a] In the article referred to, Richards gives an account of the use of metallic aluminum in aluminum coins, in aluminum paper, and in aluminothermy in making alloys and bronzes. He also devotes some attention to welding processes in which aluminum is used, and to miscellaneous uses of the metal. Information regarding patents taken out involving aluminum are published in current numbers of the Engineering and Mining Journal. Copies of these patents may be secured from the Commissioner of Patents, Washington, D. C., at a nominal price. The more recent applications of aluminum have been summed up by J. T. W. Echevarri,[b] and a brief summary of this writer's article was published in this report for 1908.[c] As the timeliness of this summary does not appear to have passed, it will be repeated here with additions.

Aluminum is used in iron and steel works for removing oxygen from the oxides of iron and other substances, the heat generated being so great as to raise the temperature of large bodies of iron. It also has the power of combining chemically with those gases imprisoned during the cooling of the metal, thus preventing porosity. For these purposes the metal is either used in the form of an alloy known as "ferroaluminum," or as the pure metal, either in the granulated or bar form or in small pieces weighing uniformly one-eighth or one-fourth of an ounce each. This property of keeping molten metal hot or of raising the temperature of a molten metallic bath has been utilized in the thermit welding process, invented by Goldschmidt. In this process aluminum and iron oxide are intimately mixed in a finely divided state and ignited by means of a fuse. The heat of combustion in the ensuing reaction raises the temperature of the casting to the welding point. The reaction takes place in a funnel-shaped crucible, from which the fluid metal resulting from the reaction is run into a suitably shaped mold formed around the area of the joint to be made, which is preheated by means of a blow lamp to avoid chilling the first lot of metal coming through.

Aluminum is used in constantly increasing quantities in the motor-car industry, combining as it does both lightness and stiffness. It is used in making crank cases, gear boxes, carburetors, radiators, dashboards, etc., besides in smaller ways. Its use in this comparatively recent industry is of interest, and especially so is its application in the newborn art of aviation, where the same qualities of lightness and stiffness again recommend it.

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[a] Mineral Industry during 1908, vol. 17, 1909, pp. 21–29.

[b] Mining Journal, November 14 and 21, 1908.

[c] Mineral Resources U, S. for 1908, pt. 1, pp. 704–705.

In castings it has been found advantageous to alloy the metal with copper, zinc, or nickel, which increases its strength and makes it easier to work. The prevailing low prices of ingot aluminum have resulted in a greatly enlarged demand for the metal for such work. The principal demand for such castings has come from automobile builders. The users of brass castings, especially the manufacturers of electrical apparatus, have been gradually changing from brass to aluminum castings, and for some purposes aluminum castings have been substituted for iron castings. The use of zinc for hardening purposes has been condemned by some writers, but according to Jesse L. Jones [a] this condemnation is unwarranted. According to this writer,

> where cost is not of primary importance, where castings must be bent, and where the alloy must be as light as possible, copper-hardened aluminum should be used; but where a moderately light alloy is satisfactory, where castings do not have to bend, where low cost of productions is essential and a high tensile strength is desirable, properly made aluminum-zinc alloys leave little to be desired.

Aluminum is one of the most malleable of all metals. Morever, it takes and retains a very high polish. For these reasons it is used in connection with the manufacture of articles of everyday use almost without limit. Somes of these new uses are as wall "paper," ceiling panels, stamped or hammered trays, finger plates, etc., in the form of very thin sheets; as a substitute for lithographic stones and zinc plates; and in the panels of car and carriage bodies. The advantages of aluminum in the manufacture of cooking utensils is well known; among these advantages are long life, noncorrosion from acids, and lightness.

In the form of powder aluminum is used to an increased extent in the manufacture of metallic paints and varnishes, its property of not tarnishing making it particularly suitable for this purpose. The paint is valuable in protecting iron and in rendering woodwork partly fireproof when applied in thick coats.

In the form of tubes it is used by acid and rubber manufacturers. A new product is bimetallic tubing, which is made of aluminum and steel, with the outer sheet of aluminum and the inner of steel, or vice versa. The same combination may be made with aluminum and copper.[b]

The subject of the alloys of aluminum is so vast that it can only be briefly referred to here. Great strides have been made in the study of this subject in recent years. The alloys in most common use are those of aluminum combined with zinc, copper, and nickel. A new alloy which has attracted some attention is known as magnalium. As prepared by Dr. Ludwig Mach, 2 to 12 parts of magnesium added to 100 parts of aluminum produce an alloy lighter than aluminum and possessing the workability and strength of brass. One of the most valuable features of the alloy is the ease with which i. can be turned, planed, or drilled.

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[a] Metal Industry, January, 1910, vol. 8, No. 1, p. 16.

[b] See article by Edward K. Davis, on the use of aluminum for noncorrosive purposes, in which is described the application of the bimetallic tube; The Metal Industry, March, 1910, p. 121.

ALUMINUM SALTS.

PRODUCTION.

The output of alum in the United States in 1909 increased 20 per cent, as compared with that of 1908, but was not so great as the output in 1907. The production of this chemical in the last ten years has shown great fluctuations. The quantity of aluminum sulphate produced increased 18,111 short tons, or 19 per cent. The production of this article has also fluctuated, but on the whole it has shown progress. The imports of refined alumina and of compounds of alumina were but 52 short tons more than in 1908. The following table gives the domestic production, the imports, and the value of aluminum salts from 1905 to 1909, inclusive:

Production and imports of aluminum salts into the United States, 1905-1909, in short tons.

Year.	Production.						Imports.[a]	
	Alum.			Aluminum sulphate.				
	Quantity.	Value.	Per ton.	Quantity.	Value.	Per ton.	Quantity.	Value.
1905	10,114	$289.716	$28.65	93,917	$1,660,515	$17.67	1.282	$26.242
1906	15,613	450,125	28.83	89,246	1,613,050	18.07	1,183	23,193
1907	10.404	361,900	34.78	106,821	2,008,046	18.80	1,562	35,191
1908	7,700	236.710	30.74	97,255	1,835,213	18.87	1,407	24.929
1909	9,237	295,682	32.01	115,366	2,214,122	19.19	1,459	29,061

[a] Includes alumina, aluminum hydrate, or refined bauxite, alum, alum cake, aluminum sulphate, aluminous cake, and alum in crystals or ground.

NEW OCCURRENCE.

In December, 1910, a specimen of alunite (hydrous double sulphate of potassium and aluminum) of a very unusual type was sent to the United States Geological Survey by Mr. A. E. Custer, of Salt Lake City, Utah. The material also contains a small amount of phosphoric acid. The occurrence is reported to be located near Richfield, Sevier County, Utah, near the railroad. It varies from 6 to 10 feet in thickness.

USES.

One of the principal uses of alum is in the paper trade, where it is utilized for sizing or giving a hard finish to paper. Aluminum sulphate and also potash alum are used in the purification of water. Crystals of potash alum are also used in the dyeing trade. A small amount of alum is used in the manufacture of medicine. Recent experiments have shown the possibility of making carbonate of aluminum. The experimental work along this line was referred to in the report on bauxite and aluminum for 1907.

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ANTIMONY.

By Frank L. Hess.

PRODUCTION.

No production of antimony ore in the United States during 1909 has been reported to the United States Geological Survey. There was, however, a considerable quantity of antimonial lead produced as a by-product in the smelting of other metals and in the refining of pig lead by the electrolytic process. As most of the antimony used goes into lead alloys, antimonial lead is a convenient form in which to handle antimony and there is no necessity for separating it from the lead. Besides the production of antimonial lead, a large quantity of antimony was recovered from various wastes, such as drosses, residues, old type, babbitt metal, journal bearings, etc.[a] Of this quantity, about 27 tons was recovered as antimony and 1,529 tons was recovered as a component of various alloys, a total of 1,556 tons of recovered antimony. Reports were received from 23 companies.

The production of antimony in the United States since 1903 has been as follows:

Production of antimony in the United States, 1903–1909, in short tons.

Year.	Contained in antimonial lead of domestic origin.		Contained in antimonial lead of foreign origin, but smelted in the United States.		Antimony produced from domestic ore.		Recovered from old alloys, scrap, dross, etc.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
1903	2,558	$445,092	....	....	570	$103,341	....	....
1904	2,571	443,598	....	....	[a] 486	61,926	....	....
1905	2,747	588,354	....	....	493	117,433	....	....
1906	1,362	[b] 544,800	....	....	[c] 404	58,149	....	....
1907	1,561	[d] 508,886	....	....	[c] 351	77,300	....	....
1908	2,440	[e] 390,400	....	....	(f)	(f)	....	....
1909	1,617	[g] 252,252	743	[g] 115,908	(f)	(f)	1,556	[g] $242,763

[a] Estimated from the average content of the ore.
[b] Estimated from the prices current for the year.
[c] Figured as 60 per cent of domestic ores only; direct figures from the smelters could not be obtained.
[d] Estimated, using 16.3 cents as the average price per pound.
[e] Estimated, using 8 cents as the average price per pound.
[f] None produced from domestic ore. Figures not collected for foreign ores.
[g] Estimated, using 7.8 cents as the average price per pound.

IMPROTS.

Imports of antimony and antimony compounds entered for consumption during 1909 were large. The imports of antimony metal and regulus, 9,557,956 pounds, were larger than in 1908 and practically equal to the imports for 1907; but the value, $620,117, was less than that of the smaller quantity imported in 1908 (8,089,915 pounds, valued at $771,206), and not half of the value of the nearly equal quantity imported in 1907, when imports of 9,600,901 pounds were valued at $1,407,861.

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[a] Figures collected by John P. Dunlop, of the United States Geological Survey.

In the following table the imports of antimony and antimony ore for consumption are given since 1899 in order to show the great variation in both quantity and value of the imports from year to year. Importations of salts of antimony are given only since 1903, the earliest year for which the Survey has obtained statistics:

Antimony, antimony ore, and salts of antimony imported and entered for consumption in the United States, 1899–1909, in pounds.

Years.	Metal and regulus.		Crude antimony and ore.		Oxide and salts of antimony.		Total value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
1899	2,990,915	$241,685	3,968,654	$47,427	....	....	$289,112
1900	3,654,822	287,937	6,089,134	75,866	....	....	363,803
1901	3,640,505	254,529	1,682,301	22,720	....	....	278,066
1902	5,388,739	333,601	3,129,069	62,968	....	....	396,569
1903	4,694,309	260,144	2,714,617	54,316	916,468	$66,469	380,929
1904	4,268,045	248,726	2,488,518	50,414	981,026	70,668	369,808
1905	4,941,247	431,228	1,970,788	53,026	1,010,228	80,130	564,384
1906	10,305,734	1,391,289	1,972,658	125,841	764,070	99,251	1,616,279
1907	9,600,901	1,407,861	2,771,387	180,903	682,192	98,038	1,686,802
1908	8,089,915	771,206	3,287,218	106,930	623,125	65,898	944,034
1909	9,557,956	620,117	3,453,542	94,249	955,360	60,353	774,719

APPARENT CONSUMPTION.

The apparent consumption for the year is the sum of the antimony imported, smelted from imported crude antimony and ore, produced in antimonial lead of both foreign and domestic origin, and recovered from secondary sources, such as old alloys, scrap, etc. If the recovery from imported crude antimony and ore is taken as about 50 per cent of the gross weight, the sum of the items named is 9,558 tons. This is exclusive of the antimony contained in oxide and salts, which would probably add 200 or 300 tons more.

The real consumption would have to take into account the stocks of antimony held at the beginning and the end of the year, and the imports and exports of type metal and of other antimonial alloys.

PRICES.

The price of antimony was fairly steady during 1909. According to the annual statistics issued by "The American Metal Market," of New York, the year opened with an average price for Cookson's of 8.11 cents during January. The price dropped until it averaged 7.95 cents during March. There was then a gradual rise, and during August the average price was 8.55 cents. Prices then gradually dwindled until November, during which month and December the average price per pound was 8.375 cents. The average price of Cookson's for the year was 8.27 cents per pound. Other brands were one-eighth to one-half cent less per pound.

BISMUTH.

By Frank L. Hess.

Production.—The only production of bismuth in the United States during 1909 reported to the United States Geological Survey was made by the United States Metals Refining Company as a by-product at its electrolytic lead refinery (Betts process), at Grasselli, Ind. The bismuth is obtained from the anode muds of lead bullion. The bullion comes largely from the Utah lead ores smelted at the company's plant at Bingham Junction, Utah. Most of the lead ores carrying bismuth come from the Tintic district, but the company buys bismuth-bearing lead, gold, and silver ores from other districts and States. More was recovered in 1909 than in previous years. As the output is that of a single firm, the figures may not be disclosed.

The Monsanto Chemical Company's electrolytic lead plant at St. Louis was idle during 1909. It was built to operate on bismuth-bearing bullion from Mexico, but the bullion produced at the mine on which it expected to draw was sent to England for refining.

Many tungsten ores carry bismuth, and one company is known to save it as a by-product when reducing the tungsten. Some bismuth is recoverable in the electrolytic copper refineries, and experiments have been carried out toward this end, but no saving has yet been reported to the United States Geological Survey. It seems entirely possible that the United States may in time put its markets beyond foreign domination by saving the bismuth which at present goes to waste in various smelting industries.

Bolivia is the principal bismuth-producing country, and from it, during 1909, bismuth ore amounting to 481,215 pounds, valued at $188,574, was exported.[a] Smaller quantities were produced in Queensland, New South Wales, and Tasmania.

Other countries that are either actual or possible producers of bismuth are Bohemia, Mexico, Norway, Peru, Portugal, Saxony, and Spain.

Imports.—The imports of metallic bismuth for consumption during the last six years have been as follows:

Imports for consumption of metallic bismuth into the United States, 1904–1909, inclusive, in pounds.

Year.	Quantity.	Value.
1904	185,905	$339,058
1905	148,589	318,007
1906	254,733	318,452
1907	259,881	325,015
1908	164,793	257,397
1909	183,413	286,516

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[a] Figures furnished by the Bureau of American Republics, Washington, D. C.

Prices.—The price of bismuth and its compounds is closely governed by foreign firms. During 1909 the price of bismuth through the whole year was quoted at from $1.70 to $1.80 per pound. If the price of bismuth were materially reduced, the use would undoubtedly largely increase. Throughout the year 1909[a] bismuth compounds sold as follows, per pound: the citrate, $1.85 to $1.90; the salicylate, $1.25 to $1.30; the subcarbonate, $1.65 to $1.70; the subgallate, $1.35 to $1.40; and the subnitrate, $1.40 to $1.45.

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[a] Paint, Oil, and Drug Reporter, weekly prices.

TUNGSTEN.

By Frank L. Hess.

TUNGSTEN INDUSTRY BY STATES.

With the recovery of the steel trade during 1909 prices for tungsten rose above those of 1908, and mining quickly responded. The mines in Colorado (Boulder County) and in California turned out quantities of ore comparable with those of 1907, and properties were developed at Deer Trail, Stevens County, Wash., and at Osceola, Nev., which promised a considerable effect in the near future upon the tungsten trade of the United States. Interest in and knowledge of tungsten minerals have become so widespread that prospectors generally are on the lookout for them, and new occurrences are reported from time to time.

Arizona.—A few tons of hübnerite were produced in Arizona at Dragoon, and from the Maudina mine in the Old Hat district, Santa Catalina Mountains, northeast of Tucson, a quantity of scheelite was produced but not sold. The scheelite occurs with gold and silver and iron oxides. A small quantity of wolframite was produced in the Aquarius Range, Mohave County, Big Sandy district.

California.—The Atolia Mining Company, operating the Papoose, Par, Flat Iron, East Union, Churchill, and Spar claims at Atolia, San Bernardino County, Cal., is much the largest tungsten operator in the State. Besides the principal claims mentioned, it holds many others from part of which either the company or its lessees have produced ore in commercial quantities. These include the Rain Storm and the Toboggan. There are 9 shafts down from 50 to 250 feet and a large number of drifts and stopes. The only tungsten mineral found is a peculiarly white scheelite of very high purity. Several analyses made in the chemical laboratory of the United States Geological Survey of specimens collected by the writer showed silica to be the only perceptible impurity. Although undoubtedly able to operate profitably at a lower rate, the company kept the mill and mines closed when the price of tungsten fell below $5 per unit. The milling plant is operated with water shipped by the Atchison, Topeka and Santa Fe Railway from its wells at Hinkley, distant about 37 miles. Up to August 28, 1909, the rate for water had been $15 per car of 9,406 gallons. On that date the rate was raised to $24.30 per car. The miners considered this rate too high, and upon their serious protest the railroad company at about the close of the year had promised to lower the rate, it was understood, to $16.45 per car.

The Atolia Mining Company's mill is equipped with gutters, so that the water falling on the roof during the infrequent rain or snow storms is saved and used for milling. The plant contains a Blake crusher, a 5-foot Huntingdon mill, and 6 Wilfley slimers. A part of the ore is broken to the size of a walnut and hand cobbed. The percentage of tungsten trioxide carried by the product is high, running from 65 to more than 73 per cent.

Near the end of 1909 this company acquired the Gold Stone claim of Charles Wetherbee & Co. The Gold Stone lies on the north side of the main group of claims of the Atolia Mining Company. It has an inclined shaft about 100 feet deep following the vein. Some good scheelite ore appears in the shaft and in a drift on the west side at the bottom. Nothing was produced during 1909.

Adjoining the Gold Stone on the east and on the same vein is the Cora Dee, owned by William Greenwood. Three shafts have been sunk to depths of 60 to about 100 feet. Only a small production has been made from the claim, and none was made during 1909.

About 2 miles north of Atolia, W. A. Wickard and associates hold the Cock Robin claims Nos. 1 and 2, on which only prospecting and assessment work was done during 1909. A scheelite-bearing vein, which is at one place 22 inches thick, is exposed in a shaft to a depth of 45 feet, where the vein pinches out. The same vein is exposed in trenches on the east side of the shaft.

In an old stream bed about 2 miles southeast of Randsburg J. I. E. Pagh "dry washed" several tons of scheelite pebbles from the gravel during the year.

A small quantity of scheelite was produced by M. D. Hamilton at Paris, between 30 and 35 miles in a direct line west of Atolia.

South of Desert, San Bernardino County, John H. Williams held leases upon a number of claims carrying both wolframite and scheelite, from which some ore was taken out, but none was shipped during 1909.

Colorado.—Colorado was again the leading State in the production of tungsten ore. The ore was all ferberite and all from Boulder County.

Practically all the ore of the Boulder County field was produced or bought by the Primos Mining Company, of Cardinal, a subsidiary company of the Primos Chemical Company, of Primos, Pa., and the Wolf Tongue Mining Company, of Nederland, a subsidiary company of the Firth-Sterling Steel Company, of Pittsburg, Pa. The Primos Mining Company did not enter the field as a large buyer, but planned a large new mill, intending to buy ore upon its completion. The company dismantled the old Stein & Boericke mill at Sugar Loaf and milled the ores from its mines at Cardinal. The Lone Tree and the Conger mines were operated by this company in 1909. In the lowest level of the Conger mine, at a depth of about 350 feet, the ore is as rich and as plentiful as it has been nearer the surface. This is the largest tungsten mine in the United States.

The Wolf Tongue Mining Company did not operate its own properties, but work was done upon them at a number of places by lessees. These are generally men with little capital who do not go much below water level—generally about 50 feet below the surface—unless they are following very rich ore or unless the ore can be easily reached by an adit. Besides the ore produced from its own properties, the company bought most of the ore produced in the district by individuals and companies other than the Primos Mining Company.

Both companies sack and ship, without milling, ores carrying 30 per cent or more of tungsten trioxide. Such ore can be profitably smelted without further concentration. There is said to be less loss in smelting ores of such a grade than there is in milling the ores and smelting the concentrates. It is probable that the saving in the mills is under 80 per cent of the tungsten contained in the ore. During 1909 the canvas plant of the Primos Mining Company's mill at Cardinal was considerably enlarged, with an increased saving of slimes. Besides other improvements in its mill, the Wolf Tongue Company put in a settling tank through which the overflow from the slimers passes. This device effected an important saving.

Eugene Stevens was in charge of tungsten mining upon the Rogers tract during the year, and an output was made from a number of openings. Farther down Boulder Creek several tungsten properties were operated. Much of the ferberite in the ores from the mines in the northeastern part of the district is in extremely small particles distributed through dark quartz or "hornstone," as it is locally known, and is very difficult to save in milling.

Lessees took out some ore from the Tungsten Mining, Milling and Exploration Company's property between Nederland and Beaver Creek, but the company itself did no work during the year.

Some work was also done on the property of the Tungsten Mines Company.

Over the line in Gilpin County, about 2 miles east of Rollinsville, W. T. Howell, F. H. Berger, and E. M. Greene took out a small quantity of ferberite.

During 1909 only a small quantity of ore was taken from the Colorado Tungsten Corporation's property, which lies a short distance northeast of Nederland.

In the Sugar Loaf district, lying farther northeast of Nederland, only a small quantity of ore was mined.

The total output of tungsten ore from Boulder County during 1909, reduced to a basis of 60 per cent tungsten trioxide, was 993 tons of 2,000 pounds, valued at $391,160. The preliminary figures given by the Survey at the beginning of the year were much larger, owing to an error in the returns received from one company. Boulder County produced 584 short tons in 1908 and 1,146 short tons in 1907.

Idaho.—A few tons of hand-picked scheelite were mined in Idaho from the United Golden Chest mine at Murray, Shoshone County.

Montana.—A hübnerite deposit, specimens from which greatly resembled the material from the Birdie mine at Butte, was discovered near Daniels, Mont., but prospecting did not seem to afford encouragement for further work. A deposit of wolframite was reported from Goodrich Gulch, near Twin Bridges, but examined specimens of the supposed tungsten ore were specular hematite.

Nevada.—The hübnerite deposits 12 miles south of Osceola, Nev., which have been held for years by J. H. Marriott and the Tungsten Mining and Milling Company, were sold in the fall of 1909 to Oscar A. Turner, who organized the Hübnerite-Tungsten Company. About 30 men were employed in prospecting and development work during the remainder of the year and a large amount of work was done. A mill was planned so that the ore could be concentrated at the mine. This is especially necessary, as there is a 45-mile haul to Ely, the nearest railroad point.

At Round Mountain the hübnerite deposits of the Round Mountain Monster Mining Company became the property of the Shoshone Tungsten Mining Company. Little was done beyond the annual assessment work.

At Browns, a station upon the Southern Pacific railroad, near the southern boundary of Humboldt County, the Atolia Mining Company of San Francisco did further prospecting work on a scheelite deposit upon which it began work in 1907. A carload of ore was shipped to San Francisco for testing early in 1909.

Washington.—A few tons of hand-picked hübnerite were shipped from the Deer Park Mining Company's mine, known as the Tungsten King. The mine is located 10 miles north of Deer Park, Stevens County, Wash. The hübnerite occurs in quartz veins cutting metamorphosed shales, and is accompanied by smoky quartz, cosalite (a bismuth-lead sulphide which carries silver at this place), pyrite in cubical crystals, and gold.

The Germania Mining Company's mine, the Germania, located in the Springdale mining district near Deer Trail, Stevens County, was closed from the fall of 1907 to August, 1909, on account of litigation. At the latter time work was begun again and about 50 men were employed in development work. A mill with crusher, rolls, and tables was erected and the company began milling ore in December. The ore was to be shipped to Hamburg, Germany.

Other States.—Although tungsten deposits are known in the Black Hills of South Dakota and in New Mexico, no production was reported in 1909 from either of these States.

PRODUCTION.

Owing to errors in several returns of tungsten ore produced during the year 1909, the preliminary figures published in January, 1910, were too high. The figures as corrected by later returns indicate a production of 1,619 tons of 60 per cent ore, valued at $614,370. The production of tungsten ores in the United States from 1900 to 1909, inclusive, has been as follows:

Production of concentrated tungsten ores in the United States, 1900-1909, in short tons.[a]

Years.	Quantity.	Value.	Years.	Quantity.	Value.
1900	46	$11,040	1905	803	$268,676
1901	179	27,720	1906	928	348,867
1902	184	34,040	1907	1,640	890,048
1903	292	43,639	1908	671	229,955
1904	740	184,000	1909	1,619	614,370

[a] The production of tungsten ores in this country from year to year can be fairly compared in this table only since and beginning with 1906, as before that date no effort had been made to reduce the ores to a common basis of concentration. Since 1906 the ores have been, as far as possible, reduced to an equivalent of ore carrying 60 per cent tungsten trioxide (WO_3), which is the ordinary commercial basis in the United States.

PRICES.

The price of tungsten ores ranged from $5 to $9 per unit, depending upon quantity, quality, and the immediate need of the buyer. The average price was between $6 and $6.50 per unit.

WORLD'S PRODUCTION.

Although the figures from all the countries producing large quantities of tungsten ores are not yet available, enough are at hand to show that the world's production for 1909 was larger than that for 1908, and was possibly equal to that of 1907. In very few of the returns, however, is the percentage of tungsten trioxide indicated and this is a prime necessity in comparing figures. It is probable that most of the exported ore is richer than 60 per cent in tungsten trioxide, and that the figures are therefore low.

The world's production of tungsten ore, 1905–1909, by countries, estimated as far as possible in short tons of concentrates containing 60 per cent of tungsten trioxide.

Country.	1905	1906	1907	1908	1909
Africa: South Africa	....	9	211	40	[a] 16
Asia:					
Federated Malay States	....	151	89	[b] 83	[b] 99
Siam	....	....	10	....	....
India	....	....	....	....	[c] 7
Australia:					
New South Wales	251	270	451	269	[d] 431
South Australia and Northern Territory	71	230	177	40	[e] 49
Queensland	1,582	865	703	516	[f] 679
Tasmania	36	22	46	5	[g] 20
Victoria	....	....	....	3	[h] 15
Western Australia	....	....	1	....	[i] 6
East Indies:					
Billiton	....	....	4	11	....
Singkep	....	....	1	14	[j] 23
Europe:					
Austria	65	63	50	44	[k] 43
England	193	304	361	261	[l] 421
France	28	20	67	124	....
German Empire	42	57	68	46	[p] 106
Italy	36	28	18	....	....
Portugal	320	629	702	684	[m] 609
Spain	413	222	303	249	....
Oceania: New Zealand	64	121	153	87	[q] 78
North America: United States	803	928	1,640	671	1,619
South America:					
Argentina	....	326	507	548	[n] 900
Bolivia	75	75	500	187	[o] 168
Brazil	....	....	....	16	....
Total	3,979	4,320	6,062	3,898	5,289

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[a] Fourth annual statement of the trade and shipping of the colonies and territories forming the South African Customs Union, 1909, Cape Town, 1910, Table 44. The percentage of tungsten trioxide in the ores is unknown.

[b] Min. Jour., London, vol. 91, October 8, 1910, p. 1174. Exports for 1908 and 1909.

[c] Min. Jour., London, vol. 91, October 22, 1910, p. 1222.

[d] Ann. Rept. Dept. Mines, New South Wales, for 1909. Sydney, 1910, pp. 58–59. The figures given represent exports of 193.3 long tons of scheelite and 127 long tons of wolframite, a total of 320.3 long tons. Concerning scheelite the report states: "The prices realized locally ranged from £65 ($316) to £130 ($632) per ton for 72 per cent ore." The tungsten ore has therefore been considered to carry 72 per cent WO_3.

[e] Min. Jour., London, vol. 88, February 26, 1910, p. 237.

[f] Queensland Govt. Min. Jour., Brisbane, March 15, 1910, p. 122.

[g] Progress Min. Ind. Tasmania, Hobart, 1909 and 1910 (quarterly).

[h] Ann. Rept. Sec. Mines for 1909, Melbourne, 1910, p. 25.

[i] Min. Jour., London, vol. 91, November 19, 1910, p. 1320.

[j] Fiscal year June 30, 1908, to June 30, 1909. Min. Jour., London.

[k] Min. Jour., London, vol. 91, November 12, 1910, p. 1306.

[l] Mines and Quarries, Gen. Rept. with Statistics for 1909, pt. 1, Home Office, London, 1910, p. 10.

[m] Boletim commercial e maritimo, Dezembro, 1909, Lisboa, 1910, p. 791.

[n] El Comercio Exterior Argentina, Buenos Aires, 1910, p. 191.

[o] Communicated by Bureau American Republics, September 26, 1910.

[p] WO_3, Min. Jour., London, vol. 91. December 10, 1910, p. 1409. Output of Saxony

[q] Papers and reports relating to minerals and mining, Wellington, 1910, p. 17. The exports of scheelite for the year were 58 long tons thought to carry 72 per cent.

NICKEL AND COBALT.

By Frank L. Hess.

PRODUCTION.

The only metallic nickel and the only cobalt known to have been produced in the United States from ores mined in this country during 1909, came from Fredericktown, Mo., where the North American Lead Company operated a smelter for the extraction of nickel, cobalt, and copper from sulphides accompanying galena. Both nickel and cobalt were produced in this country from Ontario ores during the year.

In refining copper by the electrolytic process, the electrolyte generally soon shows nickel sulphate in solution, and must be watched in order that more than 1 per cent of the sulphate be not allowed to accumulate, as more than 1 per cent is said to affect injuriously the deposition of the copper on the cathodes. Nickel is carried in minute quantities by crude copper from many places, but which ores produce it can not ordinarily be told, as the refineries which report a nickel saving refine pig copper from many localities and from several countries. In 1909 the United States Metals Refining Company at its Chrome, N. J., plant, the Nichols Copper Company at its Laurel Hill, Long Island refinery, and the Orford Copper Company at its refineries at Constable Hook, N. Y., and Bayonne, N. J., made large quantities of nickel sulphate and nickel ammonium sulphate. The total quantity of the two salts produced during 1909 was 3,101,505 pounds valued at approximately $62,000. It is difficult to estimate how much of the entire quantity should be credited as the production of the United States, possibly a third. The distribution of this quantity among the different States would be impossible.

At Webster, N. C., the North Carolina Nickel Company spent a large amount of money putting in a plant for the electrical reduction of low-grade silicate ores. It is the intention to make a ferronickelsilicon, and thus avoid complicated metallurgical processes. The ferronickelsilicon is to be sold for steel making. The present steam plant and electrical machinery are reported to have cost $600,000. The company plans to utilize also a water power near at hand. Diamond drilling and trenches are said to show a sufficient supply of nickel ore on hand.

IMPORTS.

The imports for consumption of nickel into the United States since 1902, inclusive, as reported by the Bureau of Statistics, have been as follows:

Imports of nickel for consumption into the United States, 1902–1909.

	Nickel, nickel ore, and matte, nickel oxide, alloys of nickel with copper, etc.		Value of manufactured articles of nickel.	Total value
	Pounds.	Value.		
1902	33,942,710	$1,407,521	$30,128	$1,437,649
1903	36,217,985	1,456,605	37,284	1,493,889
1904	19,739,315	1,118,541	2,950	1,121,491
1905	31,072,206	1,958,840	3,291	1,962,131
1906	34,082,042	1,867,568	8,963	1,876,531
1907	18,598,638	2,233,867	9,159	2,243,026
1908	16,825,291	2,487,605	9,980	2,497,585
1909	22,194,102	3,034,407	1,866	3,036,273

a Includes only the nickel content of ore and matte.

The imports for 1909 were divided as follows:

Imports of nickel for consumption into the United States in 1909.

	Pounds.	Value.
Oxides	25,798	$9,235
Nickel, alloys, pigs, bars, etc	252,113	94,784
Ore and matte (nickel content)	21,916.191	2,927,975
Sheets or strips		2,413
Total	22,194,102	3,034,407

The imports for consumption of cobalt into the United States since 1901 have been as follows:

Cobalt oxide, ore, and zaffer imported into the United States for consumption, 1901–1909, in pounds.

Years.	Quantity.	Value.	Years.	Quantity.	Value.
1901	71,969	$134,208	1906	41,084	$83,167
1902	79,984	151,115	1907	48,013	74,849
1903	73,350	145,264	1908	219,098	17,077
1904	42,354	86,925	1909	12,132	11,696
1905	70,048	139,377			

EXPORTS.

The United States refines much more nickel than it can use, so that although not an important producer it is a large exporter. Exports since 1901 have been as follows:

Exports of nickel, nickel oxide, and matte from the United States, 1901–1909, in pounds.

Years.	Quantity.	Value.	Years.	Quantity.	Value.
1901	5,869,655	$1,521,291	1906	10,620,410	$3,493,643
1902	3,228,607	924,579	1907	8,772,578	2,845,663
1903	2,414,499	703,550	1908	9,770,248	3,297,988
1904	7,519,206	2,130,933	1909	12,048,737	4,101,976
1905	9,550,918	2,894,700			

VANADIUM.

By Frank L. Hess.

PRODUCTION.

The larger part of the vanadium used in this country is obtained from ore imported from Cerro de Pasco, Peru, by the American Vanadium Company, of Pittsburg, Pa. The ore is largely patronite, a sulphide of vanadium, with which are various oxides in the weathered part of the deposit.

In this country vanadium was produced in 1909 by the Vanadium Alloys Company, at Newmire, Colo., from the roscoelite-bearing sandstone at that place. Much trouble has been experienced with the melting down of the furnaces in which the ore is given a chloridizing roast, and the percentage of recovery has not been all that could be wished. About the last of the year the plant passed into the hands of the Primos Chemical Company.

The Colorado Vanadium Company established a laboratory at Boulder and pursued experiments on the extraction of vanadium from the Newmire roscoelite, but produced no ore beyond a small quantity needed in its experimental work.

The General Vanadium Company shipped two cars of vanadiferous sandstone from the Jodandy claim in the Paradox Valley, 58 miles northwest of Placerville, Colo. Most of the vanadium in this sandstone is in a black mineral, probably an oxide, but not thoroughly investigated.

In New Mexico occurrences of vanadium minerals are said to have been prospected near Hillsboro and in the Caballos Range, but no production is known to have been made.

TESTS FOR VANADIUM.

So many letters asking for tests for vanadium are received by the United States Geological Survey that the following tests, which have been found effective, are given:

To test for vanadium, the mineral may be digested with nitric acid. If hydrogen peroxide be added to the resulting liquid, a brown color will appear if vanadium is present.

Some vanadium minerals are also attacked by hydrochloric acid and by sulphuric acid. To the solution resulting from the use of either acid, hydrogen peroxide may be added, and a brown solution will show the presence of vanadium, as when nitric acid is used. If either hydrochloric or sulphuric acid is used, metallic zinc may be added after hydrogen peroxide, and a bright blue color will be given by the reduction of vanadium compounds. The same effect can be obtained in a nitric-acid solution by adding sulphuric acid, evaporating to white fumes, diluting, and adding metallic zinc. If preferred, hydrochloric acid instead of sulphuric acid may be added to the nitric-acid solution, but in that case evaporation must be carried almost to dryness at least twice to get rid of the nitric acid. The liquid may then be diluted and more acid added, followed by zinc as described.

At times the tests given above are not wholly satisfactory. In such cases, if the apparatus is at hand, through a filtered solution made alkaline with ammonia pass hydrogen sulphide (H_2S) gas until the solution is saturated. The solution will take a fine garnet or deep wine color if vanadium is present. Copper, if present, is precipitated as a sulphide and does not interfere with the test.

If commercial iron sulphide for making hydrogen sulphide gas is not at hand, pyrrhotite, galena, or zinc blende may be used with hydrochloric acid. The only accessories needed are two test tubes, one of which is closed with a cork in which is inserted a bent tube the other end of which can be placed in the solution to be tested for vanadium.

TITANIUM.

By Frank L. Hess.

During 1909 rutile (titanium oxide) was mined at two places in Nelson County, Va. The General Electric Company did a large amount of prospecting upon the Warwick farm, 7 miles northwest of Tye River post-office during the winter, spring, and summer, and later leased the American Rutile Company's mill and quarry at Roseland, about 4 miles farther northwest.

The rutile deposits on the Warwick farm were found to be so discontinuous that work was given up after more than a year's prospecting. About 100 tons of rutile ore, carrying 50 per cent TiO_2, were shipped to a Pennsylvania company for concentration, and are reported to have yielded 35 tons of concentrates.

Eighty-six tons of concentrates, carrying between 80 and 90 per cent TiO_2, were produced at the Roseland mill.

The concentrates from both places were further treated by a magnetic separator. The total value of the concentrates from both places is estimated at $10,000.

A carload of nelsonite, composed of ilmenite and apatite, was shipped from a dike near Roseland by the General Electric Company for experimental work.

The Titanium Alloy Manufacturing Company, of Buffalo, uses both rutile and ilmenite in making ferrotitanium. The company states that the ilmenite it uses comes from Canada.

No rutile is known to have been imported into the United States in 1909, but the American Rutile Company was an exporter of rutile concentrates. So far as is at present known its deposits at Roseland are the largest in the world.

The use of titanium in making steel rails increased considerably during the year. The New York Central Lines have given rails treated with ferrotitanium a long trial, and concerning these rails W. C. Brown, the president of the system, makes the following statement in a published letter:

> Under the heaviest traffic we have ever had these rails are giving perfect satisfaction.
>
> We have subjected them to the most exacting service at the throat of the Grand Central terminal yard; and under traffic which made it necessary to change other rails within six or eight months, the ferrotitanium rails, which have been in service a year, show almost no appreciable wear.
>
> In this connection I would say that the Bessemer rails rolled by the Lackawanna Steel Company for our lines for the past two years (all of which have been treated with titanium) have been the best we have ever received, and in many respects we regard them as equal, if not superior, to the average open-hearth steel. While the quality is so much better the cost is insignificant, and we are now specifying titanium alloy in all of our rails.

The use of titanium in arc-light electrodes is also growing. Of these there are two principal types, one of which is an electrode made of finely ground titanium carbide, the other is composed of magnetite, chromium oxide, and rutile.

MOLYBDENUM, URANIUM, AND TANTALUM.

By Frank L. Hess.

No production of molybdenum or uranium minerals and only a small output of a tantalum mineral is known to have been made in the United States during 1909. The demand is not large for either the metals or their salts.

The use of molybdenum in steel has not grown greatly, and no molybdenum deposits have yet been developed in this country to a point where they could be depended upon for any considerable production.

Up to the close of the year no one had established a method by which the low-grade carnotite deposits of Colorado could be profitably worked, though there are apparently large quantities of rock carrying from 1 to 2 per cent of uranium oxide (U_3O_8), while smaller lots containing as high as 8 or 9 per cent may be mined.

Tantalum incandescent electric lamps have such strong competition in tungsten incandescent lamps that the demand for tantalum minerals seems rather to have decreased than grown. A small tonnage of columbite (a tantalate and columbate of iron and manganese) was mined in 1909 by the Western Reduction Company, of Omaha, Nebr., from a claim near Keystone, S. Dak., which it was operating for amblygonite. The tantalum used in this country in 1909 was imported from Germany.

TIN.

By Frank L. Hess.

PRODUCTION.

Tin remains one of the few commercial metals of which the United States is not an important producer, although this country is the largest consumer of the metal, taking about 43 per cent of the world's production.

Alaska.—On Cape Mountain, 5 miles southeast of Cape Prince of Wales, the Bartels Tin Mining Company continued prospecting work and reported having a considerable quantity of ore on their dumps. The company has been prospecting at this point since 1903. A 10-stamp mill with concentrating tables was erected in 1905, and the following year about 10 tons of concentrates were produced. Since then there has been no production.

Southwest of the Bartels Tin Mining Company's mine and near the top of Cape Mountain, the United States-Alaska Tin Mining Company has been working since 1903 or 1904. Since 1905 it has been driving a crosscut tunnel to cut a vein exposed near the top of Cape Mountain.

Only one company, the American Tin Mining Company, operated on Buck Creek during 1909. Seventeen short tons of stream tin, carrying between 67 and 68 per cent tin, equivalent to 19 tons of 60 per cent ore, were taken out in the course of assessment and prospecting work. The ore was shipped to Penzance, England, and was sold for 33⅓ cents per pound of metallic tin contained, a total of about $12,667. Prospecting is said to have shown that the tin extends farther into the tundra on both sides of Buck Creek than had been supposed, and the installation of a dredge is contemplated. The season of 1909 was short, cold, and stormy, and only assessment work was done on other claims along the creek.

Some prospecting for tin was done on Ears Mountain, Brooks Mountain, and Lost River.

South Dakota.—The Pahasa Mining Company took over in 1909 the properties of the old Harney Peak Tin Mining and Manufacturing Company near Hill City, which had been in the hands of the court for fourteen or fifteen years. Dumps were sampled, workings were examined, and shafts were unwatered and cleaned with a view to ascertaining the real value of the deposits.

The Gertie Mining and Milling Company continued work upon its mill just south of Hill City.

At Tinton, the Tinton Reduction Company has done further work both on the mill and in the mine, and 24 short tons of tin concentrates were shipped in 1909 to Chicago and smelted, giving a return of $4,832. The pegmatite in which the ore occurs is crushed dry and a steady blast of air is driven against a falling stream of the finely crushed ore, blowing out the flat leaves of mica, which is said to be a merchantable product. The ore is reported to average 0.5 per cent tin.

Texas.—The tin deposits in the Franklin Mountains, 15 miles north of El Paso, which were owned and prospected by Mr. C. R. Morehead, of El Paso, and later by the Florella Mining Company, passed in 1909 into the hands of a new company, the El Paso Tin Mining and Smelting Company, which continued prospecting and reported having uncovered larger quantities of ore than were before known.

At Streeter, Mason County, P. H. Parker, whose discovery of tin ore was noted in the report for 1908, continued prospecting in 1909, but nothing of commercial value seems to have been developed.

Other States.—No work is known to have been done during 1909 on the deposits in North Carolina, South Carolina, Virginia, or Washington.

PRODUCTION IN FOREIGN COUNTRIES.

The world's supply of tin for the last three years, as shown by shipments and sales, has been approximately as follows:

Supply of tin in 1907, 1908, and 1909, in short tons.

	1907	1908	1909
Total shipments:			
Straits Settlements	58,800	67,760	[a] 65,459
Australia	7,112	6,552	[b] 5,992
Bolivia	17,136	19,040	[c] 23,523
South Africa	....	1,904	[d] 916
China	224	....	....
Banka sales in Holland	12,197	12,880	[b] 12,992
Billiton sales in Java	2,408	2,465	[b] 2,465
Production in Cornwall	5,488	6,048	[b] 5,802
Total	103,365	116,649	117,149

[a] Figures quoted from official sources by Min. Jour., London, vol. 88, 1910, p. 65.

[b] Exports, as given by C. Mayer in "Annual statistical report of the New York Metal Exchange for 1909," p. 13.

[c] Min. Jour., London, vol. 88, 1910, p. 336. Señor Ventura Farfan, inspector of custom houses (Bolivia), is quoted as giving the exports upon which duty was paid as 35,566.4 metric tons of barilla (concentrates) carrying 60 per cent tin. Although a part was pig tin from Oruro, it was calculated to a basis of 60 per cent concentrates.

[d] Fourth annual statement of the trade and shipping of the colonies and territories forming the South African Customs Union, Cape Town, 1910. Tin ore to the amount of 27,255 hundredweight was shipped during 1909. This is considered as giving a recovery of 60 per cent tin.

IMPORTS.

During the year 1909 the United States imported for consumption 47,662 short tons of metallic tin, valued at $27,558,546; 1,432 tons of cassiterite, valued at $68,462; tin foil valued at $23,427; and other manufactures of tin, valued at $55,714. The quantity imported has been exceeded but once before, in 1906. The imports of tin for consumption into the United States since 1901 have been as follows:

Tin imported and entered for consumption in the United States, 1901–1909, in short tons.

Years.	Quantity.	Value.	Years.	Quantity.	Value.
1901	37,280	$19,024,761	1906	50,477	$37,447,315
1902	42,522	21,263,337	1907	41,257	32,074,263
1903	41,567	22,265,336	1908	41,267	23,923,560
1904	41,472	22,356,895	1909	[a] 47,662	27,558,546
1905	44,188	26,316,023			

[a] Does not include the tin contained in imported ore, tin foil, or other manufactures.

PRICES DURING 1909.

The average price of tin as indicated by the imports for consumption during 1909 was 28.91 cents per pound. As given by C. Mayer[a] the average price in New York for the year was 29.69 cents per pound. "Metal statistics, 1910,"[b] gives the average price as 29.76 cents per pound.

There was a gradual, steady rise in the monthly average of prices from about 28 cents per pound in January to about 29¾ cents per pound for December. The lowest price was 27¼ cents in February, and the highest was 34⅛ cents, reached in December. Although the average price for the year was very little more than during 1908 (about 29.5 cents), the fluctuations were somewhat greater. During 1908 the lowest price was about 26.5 and the highest about 32.5 cents per pound.

RECOVERED TIN.

Statistics gathered by John P. Dunlop, of the United States Geological Survey, indicate growth in the recovery of tin from tin scrap, used tin cans, old tin pipe, worn driving-box linings, drosses, old solder, bronze, sweepings, etc. From these materials the recovery of tin is commonplace and expected, except from used tin cans; in them the loss of tin is enormous, and in the recovery of tin from them must be the future growth in the comparative percentage of waste material treated.

At present the Vulcan Detinning Company is recovering tin from a considerable quantity of used tin cans. In a small way cans are treated by others for recovery of their solder. A common method of recovery is to throw the cans into a small sheet-iron vertical cylinder in which is a wood fire; such solder as runs down into the ashes is collected and remelted into more salable form.

The tin recovered during the year as tin amounted to 2,423 short tons; in the form of alloys, such as solder, babbitt metal, bronze, etc., 3,092 short tons were recovered, a total of 5,515 tons, equal to more than one-ninth of the tin imported into this country and worth at the average price for the year (about 29.75 cents per pound) $3,281,425. Besides the money value involved, the world's tin resources were increased by so much—a very real conservation.

In Europe there was also a large saving of tin from various wastes, but the quantity is unknown.

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[a] Op. cit., p. 17.

[b] p. 118.

CHROMIC IRON ORE.

By Ernest F. Burchard.

INTRODUCTION.[a]

Chromite is widely distributed through areas of serpentine and associated basic rocks in various parts of the United States. Serpentine areas are found at a few localities in the region of old metamorphic rocks east of the Appalachian region from New England to Georgia, at various points in the Rocky Mountains, throughout the extent of the Sierra Nevada and Coast Ranges in California, and at a few points in the Cascade Mountains. Chromite occurs disseminated widely through many of these areas, but its concentration is local. Chromite localities are known in Massachusetts, Pennsylvania, Maryland, North Carolina, Wyoming, and California.

No chromic iron ore has been produced in the Eastern States for many years, almost the entire production since 1880 coming from California. In 1909 the production of chrome ore, amounting to 598 long tons, came from California and Wyoming, the larger part being obtained from the latter State. The greater part of the ore mined was used for furnace linings.

As in previous years, the importation far exceeded the domestic production. In 1909 the imports of chrome ore into the United States from New Caledonia, Greece, Canada, and other countries amounted to 39,624 long tons.

Chromite is the only commercially important ore of chromium. It is a mixture of chromic oxide (Cr_2O_3) and ferrous oxide (FeO) in various proportions, the former averaging between 40 and 60 per cent, though occasionally running as low as 10 per cent, the latter running from 10 to 50 per cent. The theoretical composition of chromite is $Cr_2O_3.FeO$ (Cr_2O_3 68 per cent; FeO 32 per cent). The price is based on 50 per cent ore.

Chrome ore is used extensively in the manufacture of ferrochromium, employed for making special steels, alone or in combination with tungsten, manganese, nickel, or other steel-hardening metals. It is also used for lining copper, lead, steel, and other furnaces where the corrosive action is very great. For this purpose it is used either in the crude form or as chrome brick. A third use of chromite is in the manufacture of various chromium compounds, such as oxides and metal chromates for use as pigments and as dyes, and alkaline bichromates for use as mordants and as tannages.

A more complete discussion of the sources, uses, and occurrence of chromite was published in the report on chromic iron ore for 1908.[b]

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[a] Notes on occurrence, sources, and uses by E. C. Harder, of the United States Geological Survey.

[b] Harder, E. C., Chromic iron ore: Mineral Resources U. S. for 1908, pt. 2, U. S. Geol. Survey, 1909, pp. 751-771.

STATISTICS OF THE CHROMIC IRON-ORE INDUSTRY.

Production.—The quantity of chromic iron ore marketed in 1909 amounted to 598 long tons, valued at $8,300, as compared with 359 long tons, valued at $7,230, in 1908. More than half the ore in 1909 was mined in Converse County, Wyo., and was shipped to Pueblo, Colo., for use in furnace lining, except a small quantity shipped to St. Louis, Mo., for the manufacture of refractory brick; the remainder came from Siskiyou County, Cal., and was used for lining local furnaces. The stock of chromite at the mines at the close of 1909 amounted to about 152 long tons, according to reports received by the Survey. No domestic ore was used in the manufacture of chrome alloys, potassium bichromate, chrome paints, dyes, or other chemical materials.

The following table gives the quantity and value of chrome ore produced in the United States since 1880. All the ore was obtained from California, except the production from Wyoming in 1908 and 1909.

Production of chromite in the United States, 1880–1909, in long tons.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
1880	2,288	$27,808	1895	1,740	$16,795
1881	2,000	30,000	1896	786	6,667
1882	2,500	50,000	1897	....	....
1883	3,000	60,000	1898	....	....
1884	2,000	35,000	1899	....	....
1885	2,700	40,000	1900	140	1,400
1886	2,000	30,000	1901	368	5,790
1887	3,000	40,000	1902	315	4,567
1888	1,500	20,000	1903	150	2,250
1889	2,000	30,000	1904	123	1,845
1890	3,599	53,985	1905	22	375
1891	1,372	20,580	1906	107	1,800
1892	1,500	25,000	1907	290	5,640
1893	1,450	21,750	1908	359	7,230
1894	3,680	53,231	1909	598	8,300

Prices.—The price of chrome ore varies from $10 to $20 per ton, according to grade of ore and conditions of supply. Imported ore from New Caledonia carrying 50 per cent chromic oxide is quoted in New York at $14 to $16 per long ton, exclusive of cost of transportation. If the chromic oxide exceeds 50 per cent, the value of the ore rises in proportion; if the chromic oxide is less than 50 per cent, the value of the ore decreases at a more rapid rate. The price of the California ore is governed almost entirely by local conditions, as there is little or no competition with foreign ores.

The price of chrome bricks f. o. b. Pittsburg is $175 per thousand. American potassium bichromate was sold at 7½ cents to 8 cents per pound and the Scotch product at 10¾ cents per pound in the latter part of 1909.

Imports.—During the last six years important quantities of chromite have been imported from New Caledonia, Greece, Canada, Great Britain, Asiatic Turkey, and Japan, and minor quantities from European Turkey, Belgium, Germany, France, Cuba, Australia, Tasmania, New Zealand, and Portuguese Africa. In 1909 Canada exported 1,794 short tons of chromite, valued at $20,858, according to the official preliminary report.

The total ore imported in 1909 amounted to 39,624 long tons, valued at $460,758, as compared with 27,876 long tons, valued at $345,960 in 1908.

The following table shows the imports for consumption of chrome ore and of various manufactured chromium products into the United States since 1867:

Chromate and bichromate of potash, chromic acid, and chrome ore imported and entered for consumption in the United States, 1867 to 1909, inclusive.

Year ending—	Chromate and bichromate of potash.		Chromic acid.		Chrome ore.		Total value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
June 30—	*Pounds.*		*Pounds.*		*Long tons.*		
1867	875,205	$88,787	...	...	...	...	$88,787
1868	777,855	68,634	...	...	...	...	68,634
1869	877,432	78,288	...	$3	...	...	78,291
1870	1,235,946	127,333	...	8	...	...	127,341
1871	2,170,473	223,529	...	5	...	...	223,534
1872	1,174,274	220,111	514	49	...	...	220,160
1873	1,121,357	178,472	922	276	...	...	178,748
1874	1,387,051	218,517	44	13	...	...	218,530
1875	1,417,812	183,424	45	22	...	...	183,446
1876	1,665,011	175,795	120	45	...	...	175,840
1877	2,471,669	264,392	13	10	...	...	264,402
1878	1,929,670	211,136	32	35	...	...	211,171
1879	2,624,403	221,151	...	...	...	...	221,151
1880	3,505,740	350,279	5	3	...	...	350,282
1881	4,404,237	402.088	124	89	...	...	402,177
1882	2.449,875	261,006	52	42	...	...	261,048
1883	1,990,140	208,681	290	338	...	...	209,019
1884	2,593,115	210,677	...	120	2.677	$73,586	284,383
1885	1,448,539	92,556	...	39	12	239	92,834
Dec. 31—							
1886	1,985,809	139,117	...	101	3,356	43,721	182,939
1887	1,722,465	120,305	...	5,571	1,404	20,812	146,688
1888	1,755,489	143,312	...	281	4,440	46,735	190,328
1889	1,580,385	137,263	...	2,974	5,474	50,782	191,019
1890	1,304,185	113,613	...	634	4,353	57,111	171,358
1891	755,254	55,897	634	203	4,459	108,764	164,864
1892	496,972	94,055	772	204	4,930	55,579	149,838
1893	976,706	78,981	3,708	641	6,354	58,629	138,251
1894	1,483,762	125,796	5,680	837	3,470	38,364	164,997
1895	2,045,910	181,242	2,083	414	5,230	82,845	264,501
1896	952,794	80,538	2,429	387	8,669	187,400	268,325
1897	1,329,473	108,497	71,220	5,457	11,570	187,439	301,393
1898	1,160,710	86,134	5,329	1,758	16,304	272,234	360,126
1899	1,130,965	73,510	33,134	6,360	15,793	284,825	364,695
1900	111,761	7,758	35,452	7,232	17,542	305,001	319,991
1901	430,996	29,224	53,462	10,861	20,112	363.108	403,193
1902	...	...	90,817	11,115	39,570	582,597	593,712
1903	41,229	2,784	57,799	5,465	22,932	302,025	310,274
1904	26,053	1,817	87,721	10,505	24,227	348,527	360,849
1905	59,650	4,225	38,555	4,657	54,434	725,301	734,183
1906	30.098	2,124	1,307	331	43,441	557,594	560,049
1907	18,171	1,307	1,834	403	41,989	491,925	493,635
1908	216,081	15,453	3,805	708	27,876	345,960	362,121
1909	537,017	28,837	7,559	1,412	39,624	460,758	491,007

PLATINUM AND ALLIED METALS.

By Waldemar Lindgren.

PLATINUM.

DOMESTIC PRODUCTION.

CRUDE PLATINUM.

The conditions of platinum production in the United States, where the metal is obtained mainly as a by-product in placer gold mining, did not change materially during 1909. The product, though varying considerably, has been on the whole larger since 1900 than in the preceding decade. The production of crude platinum in 1909 was 672 troy ounces; the reported value was $12,803, or a trifle over $19 per ounce. Crude platinum generally contains iridium, iridosmine, and gold, besides some remaining black sand. The platinum content of the crude sand varies somewhat, the average being probably about 80 per cent.

The entire output of crude platinum in the United States is recovered from placer mines in Oregon and California, which also produce gold. The production of California in 1909 amounted to 395 troy ounces of crude platinum, valued at $7,863. Of this, 301 ounces were recovered as a by-product in dredging operations in Butte, Yuba, and Sacramento Counties; smaller quantities were recovered from river gravels in Siskiyou and Trinity counties, and a few ounces from workings in beach sands in Humboldt County.

In Oregon the principal production reported comes from beach sands near Port Orford, in Curry County, and near Bullards, in Coos County. The quantity recovered in 1909 was 277 troy ounces, valued at $4,940.

No production was reported from the Rambler mine, in Wyoming, nor from the deposit recently discovered in southern Nevada and described in Mineral Resources for 1908.

REFINED PLATINUM.

The production of refined platinum from crude metal derived from placers is calculated on the basis of a content of fine metal of 80 per cent, and, thus computed, 538 fine ounces is found to have been the output from the placers in 1909.

The United States Mint obtains annually from its refinery operations a considerable quantity of platinum, the largest part of which is derived from scrap platinum and from sweepings, etc., bought from jewelers and dentists. A small percentage of primary metal is, however, obtained in refining gold bullion received at the mint from placer and quartz mines. It is almost impossible to obtain a correct value for such recovery, but it is certainly not less than 100 fine ounces. This estimated recovery may properly be added to the production of primary platinum in the United States from domestic sources, thus bringing the total output of refined platinum in 1909 up to 638 fine ounces, valued at $15,950.

Production of refined platinum from domestic ores in 1901–1909, in troy ounces.

Year.	Quantity.	Value.
1901	1,408	$27,526
1902	94	1,874
1903	110	2,080
1904	200	4,160
1905	318	5,320
1906	1,439	45,189
1907	357	10,589
1908	750	14,250
1909	638	15,950

SECONDARY PLATINUM.

Because of the strong demand for platinum which has sprung up during recent years much secondary platinum is recovered in the United States from scraps of chemical apparatus, jewelry, dental work, and incandescent-light fixtures. Owing to the peculiar conditions which exist in the platinum trade, complete statistics of this recovery can not be obtained from all refiners, but it is safe to say that the quantity thus recovered makes up a large percentage of the total imports. The principal domestic refiners of crude and secondary platinum are as follows: The United States Mint; Baker & Co. (Inc.), Newark, N. J.; Croselmire & Ackor, Newark, N. J.; S. S. White Dental Manufacturing Co., Philadelphia, Pa.; J. Bishop & Co., Malvern, Pa.; American Platinum Works, Newark, N. J.; Roessler & Hasslacher Chemical Co., Perth Amboy, N. J.

IMPORTS.

The imports of platinum from other countries, chiefly Russia, were much larger in 1909 than in 1907 and 1908, but did not reach the values recorded in 1906. The imports are shown in the following table:

Platinum metals imported and entered for consumption in the United States, 1902–1909.

Year.	Platinum ore or crude platinum, including unmanufactured products, ingots, bars, sheets, and wire.		Manufactured products, including vases, retorts, etc.	Total.
	Quantity.	Value.	Value.	Value.
	Troy ounces.			
1902	88,140	$1,950,362	$37,618	$1,987,980
1903	92,808	1,920,044	135,889	2,055,933
1904	....	....	....	1,879,155
1905	93,912	1,985,107	188,156	2,173,263
1906	137,928	3,601,120	187,639	3,788,759
1907	74,292	2,508,991	175,651	2,684,642
1908	50,844	1,095,754	134,119	1,229,873
1909	118,853	2,557,596	416,352	2,973,948

PRICES.

The following table gives the prices of ingot platinum per troy ounce at New York, by months, for the calendar years 1906, 1907, 1908, and 1909.

Prices of ingot platinum per troy ounce on the New York market in 1906, 1907, 1908, and 1909, by months.

1906.

January	$20.50	July	$26.00
February	25.00	August	26.00
March	25.00	September	33.00
April	25.00	October	33.00
May	25.00	November	38.00
June	26.00	December	38.00

1907.

January 1	$38.00	July 25	$27.00
February 20	37.00	August 1	27.50
March 20	36.00	August 15	28.00
April 1	34.00	September 20	27.00
April 10	32.00	October 20	26.50
May 10	31.00	December 1	26.00
May 20	28.00	December 15	25.50
May 25	26.00	December 31	25.00

1908.

January	$22.30	July	$19.60
February	22.10	August	18.20
March	21.80	September	18.60
April	21.75	October	21.15
May	21.35	November	24.50
June	19.85	December	24.10

1909.

January	$24.25	July	$22.50
February	24.50	August	22.00
March	23.75	September	25.50
April	24.00	October	28.00
May	23.50	November	29.25
June	23.00	December	29.50

The average price for 1909 was $24.98. There was a steady advance of price during the latter part of the year, and this advance continued in 1910.

It can not be said that there is a market in this country for crude platinum, the small producers generally having to accept whatever is offered them. In California from $12 to $14 per ounce was often paid in former years. During 1909 the prices obtained ranged from $16 to $19 per ounce. During the same period the price of crude metal having an 83 per cent platinum content at St. Petersburg ranged from $17.50 to $23.75 per troy ounce.

Owing to the scarcity of iridium the prices for "hard metal," which is an alloy of that metal with platinum, have gone up more rapidly than those for pure platinum. At the close of 1909 about $35 per ounce was asked for hard metal.

USES.

The manifold uses of platinum were mentioned in some detail in the report for 1908. It should only be added that of late a strong demand for platinum has developed in the jeweler's trade, not only for mounting precious stones, but also for making watch chains and neck chains.

FOREIGN PRODUCTION.

RUSSIA.

The total actual production of crude platinum in the Urals in 1909 is estimated at 190,087 troy ounces,[a] of which 171,120 ounces were produced by hand labor, and 18,967 ounces, equivalent to about 10 per cent, by dredging. The production was smaller than usual, and it is probable that the reserves of workable areas are becoming exhausted. The average actual output is about 0.09 ounce crude platinum per metric ton of gravel. It has often been explained that the official statistics of the production of platinum in Russia are unreliable because much of the metal is smuggled across the frontier.

In Russia platinum is produced by five large operators: The Compagniè Industrielle du Platine, The Platinum Company, Count Schouwaloff, Demidoff's Successors, and Prince Abemelik-Lazarieff. In 1900 these five operators produced 90.1 per cent of the total yield, but of late their aggregate output has declined, and in 1909 it was only 67 per cent of the total.

Almost all of the platinum produced in Russia is refined abroad, in London, by Johnson, Matthey & Co.; in Paris, by Quennesseu, de Belmont Legendre & Co.; and in Germany, by Heraeus & Co. (Hanau). The domestic refiners are mentioned above.

In 1909 the French company obtained practical control for a term of years over the output of the principal operating companies. The small producers, who formerly had no organization and whose position was becoming intolerable, held a congress at Ekaterinburg to devise measures for their relief. The Russian Government assisted, but no definite results were reached. It was suggested that the export of crude platinum be prohibited, but whether so drastic a measure, involving the breaking of contracts of producers with refiners, will be adopted by the Russian Government is doubtful.

The most reliable figures obtainable for the production of crude platinum in Russia are given in the following table:[b]

Production of platinum in the Ural Mountains in 1896–1909, in troy ounces.

1896	200,000	1905	200,450
1898	203,100	1906	210,318
1900	212,500	1907	310,000
1903	226,000	1908	250,000
1904	290,120	1909	190,087

COLOMBIA.

The platinum-bearing districts of Colombia were described in Mineral Resources for 1908. In 1909 some further progress was made and two dredges were installed, one on Condoto River, the other on the Patia.

Figures showing the total exports for 1909 are not yet available, but the exports to the United States during the last five years, according to the Bureau of Statistics of the Department of Commerce and Labor, are shown in the following table:

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[a] Hautpick, E. de, The Russian platinum industry in the year 1909; Min. Jour., London, 1910, pp. 384-386, 482-484.

[b] Min. Jour., London, May 8, 1909.

Exports of platinum from Colombia to the United States, 1905–1909, in troy ounces.

Year.	Quantity.	Value.
1905	1,140	$21,504
1906	2,316	45,763
1907	5,496	100,206
1908	1,092	25,576
1909	2,392	36,440

CANADA.

A little platinum, possibly 30 ounces, was won in the Tulameen district of British Columbia, and some of the metal was recovered in the United States from Sudbury copper-nickel matte.

NEW SOUTH WALES, SUMATRA, AND BORNEO.

A production of 440 ounces was recorded from New South Wales in 1909,[a] and Sumatra and Borneo are believed to have yielded about 500 ounces.[b]

WORLD'S PRODUCTION.

The world's output of crude platinum in 1909 is given approximately in the following table:

World's production of crude platinum in 1909, in troy ounces.

Russia	190,087
Canada	[c] 30
New South Wales	440
Colombia	[c] 6,000
United States, domestic crude	673
United States, from foreign and domestic matte and bullion	[d] 600
Borneo and Sumatra	[c] 500
Total	198,330

IRIDIUM.

Properties.—Iridium is generally present in crude platinum in alloy with osmium as iridosmine, more rarely as native metal or in alloy with platinum. In its manufacture from crude platinum it is obtained as a sponge, which is then melted with the addition of a little phosphorus.[e] Melted iridium is a brilliant white, brittle metal intermediate in color between silver and tin. Its specific gravity is 22.421 (Deville and Debray), and its fusion point is very high—2150° to 2250° C. At 1100° C. iridium begins to oxidize to a purple oxide. Tungsten has a higher melting point than iridium, but oxidizes readily. Under ordinary conditions iridium is not attacked by any acid.

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[a] Ann. Rept. Dept. Mines, New South Wales, 1909.

[b] Min. Jour. London, May 8, 1909.

[c] Estimated.

[d] Estimated, refined.

[e] Moissan, Traité de chimie minérale, vol. 5, p. 896.

Uses.—Owing to its unique qualities iridium finds an extensive use. Most of the metal produced is probably used for the purpose of hardening platinum, the percentage of iridium in the alloys ranging from 5 to 20 per cent. Up to 10 per cent the alloys are ductile and malleable; those containing from 10 to 20 per cent of iridium are hard and difficult to work; where the alloy contains 30 per cent of iridium it is no longer attacked by aqua regia.[a] Iridium is further used for various scientific and technical purposes, such as standard weights, pivots, contact points, and fountain pen points. For certain high temperature experiments (above 1600° C.) iridium is rolled in sheets and welded into tubes. Pure iridium is difficult to work on account of its brittleness. Iridium black, an oxide of the metal, is highly valued as a pigment for decorating china ware.

Production, import, and prices.—A few ounces of iridium are probably obtained from domestic crude platinum, but figures showing the quantity are not available. According to the Bureau of Statistics 341 pounds of iridium, valued at $135,878, or about $33 per troy ounce, were imported in 1909 into the United States. The price of iridium has been increasing rapidly. In 1909 the average price was about $35 per troy ounce; in 1910 the price increased above the price in 1909, and in October, 1910, iridium was quoted at $60 per ounce.

OSMIUM.

Osmium is a hard and brittle bluish-gray metal, which, as stated above, generally occurs in combination with iridium. Its melting point is very high and its specific gravity is 22.48 (Joly and Vèzes). Thus far little use has been found for it, except for certain kinds of incandescent lamps. In 1909, according to the Bureau of Statistics, 4 pounds of osmium, valued at $1,569, or about $33.70 per ounce troy, were imported into the United States. As in the case of iridium there is little present probability of obtaining a supply of osmium from domestic sources.

PALLADIUM.

Palladium is a white metal intermediate in color between platinum and silver. It is malleable, has about the hardness of platinum and a low specific gravity—11.97 (Violle). It has a lower melting point than any other of the platinum metals—about 1549° C.

The metal occurs in crude platinum, but rarely in considerable amount. It is also found in small quantities in certain copper deposits containing pyrrhotite and chalcopyrite, generally associated with a little gold, silver, and platinum. Alloys of palladium and gold (alloys known as white gold) also occur in nature.

Palladium finds a fairly large use in technology. Circles of astronomical instruments are made of it, and it is also employed in watchmaking. Its most extensive use is probably for certain alloys in dental work. It is also employed for soldering platinum metals. The demand for this metal is considerably greater than the supply.

A certain amount of palladium is annually recovered by the Port Orford Copper Company in the treatment of matte from Sudbury,

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[a] Moissan, op. cit., p. 899.

Canada, but the figures can not be published. In 1909 the imports of metallic palladium into the United States were 33 pounds troy, valued at $13,416, or about $34 per troy ounce. Palladium also occurs, it is said, in the Rambler copper mine in Wyoming, but none was reported as recovered in 1909.

RHODIUM.

Rhodium is a white metal of the color of aluminum. It is ductile and malleable at red heat. The specific gravity of the melted metal is 12.1 (Deville and Debray); its melting point is about 2000° C. The metal occurs in crude platinum in amounts up to 4 per cent and is also contained in the platinum arsenide sperrylite, found at Sudbury, Canada.

The principal use for this metal is for thermo elements employed in high-temperature determinations. The elements consist of pure platinum and platinum alloyed with 10 per cent of rhodium.

Small quantities of the metal, with some ruthenium, have been made on an experimental scale by the Port Orford Copper Company. The price of pure rhodium is stated to be about $5 per gram, or abont $155 per ounce troy.

CADMIUM.

By C. E. Siebenthal.

INTRODUCTION.

A brief account of the production, resources, metallurgy, and uses of cadmium was given as a chapter in Mineral Resources for 1908, and to that paper the reader is referred for further information.

Cadmium has been produced in the United States during the last few years, but the chief output of cadmium comes from the zinc-producing regions of Silesia, where it is recovered as a by-product in the distillation of zinc. Recently in England a little cadmium has been recovered in the purification of the solution of zinc sulphate in the manufacture of lithopone.

PRODUCTION.

Cadmium has been recovered in the United States since 1907 by the Grasselli Chemical Company, of Cleveland, Ohio. The metallurgical method employed has generally been assumed to be fractional distillation, but this is not confirmed by the company, which prefers not to communicate the process used. Inasmuch as the production is limited to one firm, the quantity and value of the output can not be given. The local production in 1907 was nearly sufficient to satisfy the domestic demand, as shown by the small imports for that year, but the next year the quantity of cadmium imported was about doubled, and in 1909 the imports of cadmium were back at the old figures which obtained before the beginning of cadmium production in the United States. The domestic production has fallen away from the high mark set the first year, but not to the extent that might be inferred from the growth of imports in the last three years, because meanwhile the market for cadmium has somewhat expanded.

PRODUCTION IN GERMANY.

The following table gives the production of cadmium in Upper Silesia from 1882 to 1909, inclusive:

Quantity and value of cadmium produced in Germany, 1882–1909.[a]

Year.	Quantity.	Value.	Average price per pound.	Year.	Quantity.	Value.	Average price per pound.
	Pounds.				*Pounds.*		
1882	7,762	....	....	1896	23,514	$19,453.64	$0.83
1883	5,333	....	....	1897	34,231	42,037.23	1.23
1884	6,118	....	....	1898	32,954	29,666.70	.90
1885	7,222	....	....	1899	21,693	15,544.26	.72
1886	10,944	$8,710.56	$0.80	1900	29,835	19,524.81	.65
1887	16,140	11,542.29	.72	1901	28,977	19,754.71	.68
1888	10,573	5,439.49	.51	1902	27,833	15,132.00	.54
1889	11,327	4,621.71	.41	1903	36,519	19,242.06	.53
1890	9,167	3,477.18	.38	1904	55,655	32,882.32	.59
1891	6,281	2,423.32	.39	1905	54,163	35,240.18	.65
1892	7,055	2,713.20	.38	1906	47,368	36,083.89	.76
1893	11,651	5,198.87	.45	1907	72,639	60,757.35	.84
1894	15,095	8,393.31	.56	1908	72,741	48,590.21	.67
1895	15,095	9,052.04	.60	1909	81,982	46,777.16	.57

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[a] Recalculated to pounds and dollars from Statistik des Oberschlesischen Berg -und Hüttenmännischen Vereins, as quoted by Jensch, from Vierteljahreshefte zur Statistik des Deutschen Reichs and from Statistisches Jahrbuch für den Preussischen Staat.

IMPORTS.

Cadmium is imported into the United States as metallic stick cadmium and as the pigment, cadmium sulphide (CdS), "cadmium yellow." The former is free of duty; the latter is dutiable at 30 per cent ad valorem. The value of the imports for consumption of metallic cadmium for 1903 to 1909, inclusive, is given in the table below, which is taken from the records of the Bureau of Statistics. The quantities are not there recorded previous to July, 1909, and for the period preceding that time they have been computed by dividing the values of the imports by the average price of cadmium for the corresponding years in Germany, from which country the cadmium was imported. The quantity of cadmium imported as a pigment and the value thereof are not kept separately by the Bureau of Statistics.

Cadmium imported for consumption into the United States, 1903–1909, in pounds.

Year.	Quantity.	Value.
1903	[a]8,679	$4,565
1904	[a]7,655	4,524
1905	[a]8,138	5,298
1906	[a]13,808	10,522
1907	[a]1,953	$1,633
1908	[a]3,567	2,390
1909, first half	[a]6,659	4,559
1909, second half	2,203	

[a] Previous to July, 1909, the quantities are computed as noted above.

PRICES.

The domestic quotations on cadmium as reported in the Engineering and Mining Journal ranged from 60 to 75 cents per pound in 200-pound lots at Cleveland, Ohio.

According to Paul Speier, of Breslau, Germany, the price of 99½ per cent cadmium sticks at the beginning of the year was 500 marks per 100 kilograms (54 cents per pound), from which point the price declined by autumn to 400 marks per 100 kilograms (43 cents per pound). Toward the end of November an extraordinarily strong demand was induced by the discovery of a new use for the metal, large quantities were purchased, and quotations advanced to 550 marks per 100 kilograms (59 cents per pound).

SELENIUM.

By Frank L. Hess.

Selenium is known to have been made during 1909 at only one place in the United States, where a comparatively small quantity was saved. It was sold at an average price of $3.43 per pound. The uses are at present very limited, and should they so increase as to create a demand for large quantities of the element, it could be profitably sold at a much lower price. As the output is that of a single company, the figures of production may not be given.

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